Pit and Quarry

Member A. B. C.

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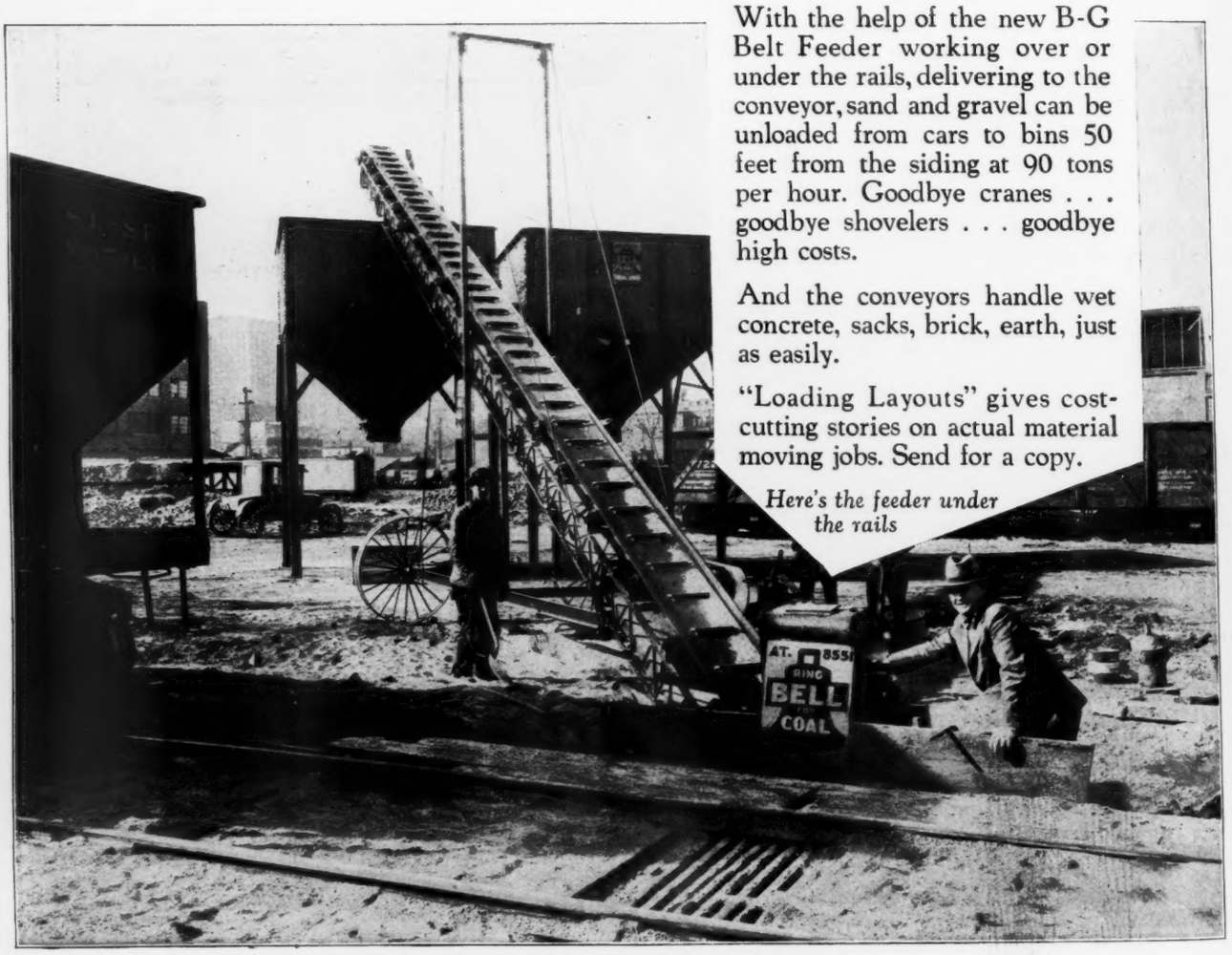

Here's the feeder under the rails

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Pit and Quarry

Vol. XVIII CHICAGO, ILL., AUGUST 14, 1929 No. 10

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is taken from our files and its selection is without significance as to current events or as to the position of the individual in the industry.

© Blank & Stoller

W. H. Hoagland

President, Marble Cliffs Quarries

Columbus, Ohio

Announcement

READERS of PIT AND QUARRY will be glad to learn that *Cement-Mill and Quarry* and the *Directory of Cement, Gypsum, Lime, Sand, Gravel and Crushed-Stone Plants,* as announced in the advertising section of this issue, have been consolidated with PIT AND QUARRY and the PIT AND QUARRY HANDBOOK, respectively. This consolidation marks an important step forward in the development of the trade journalism now serving the pit and quarry industries. Not only does it consolidate editorial effort and policies heretofore separately directed to the same field, but it brings together, also, two large units of reader interest and buying power.

Considered from the editorial point of view, the change is full of significance to pit and quarry operators. In augmenting its own already large body of readers through the addition of the many hundreds of new readers acquired by the purchase of *Cement-Mill and Quarry*, PIT AND QUARRY obtains the largest reader audience in the non-metallic field. The publisher is deeply sensible of the added weight of editorial responsibility which this position of leadership imposes, and elaborate plans for discharging it fully and creditably have been prepared.

The same high standards that have distinguished PIT AND QUARRY in the past will, of course, be maintained, and the best features of *Cement-Mill and Quarry* — those which have won a special place in the good opinion of its supporters — will be retained for the benefit of the many readers of that paper who now become a part of the PIT AND QUARRY circle. No effort or expense will be spared to make PIT AND QUARRY continue to merit the high esteem with which its thousands of readers have always regarded it, and it hopes soon to win the same approval from old *Cement-Mill and Quarry* readers who now make its acquaintance for the first time.

The economies resulting from the consolidation will make possible not only the maintenance of PIT AND QUARRY'S present low subscription price, but also the provision of a broader and much more valuable service to its readers. The August issue of *Cement-Mill and Quarry* was the last to appear in the old form, the consolidation becoming effective with the September 11 issue of PIT AND QUARRY.

To have the privilege of rendering news and editorial service to the largest reader audience in the pit and quarry industries is no common opportunity, nor is the duty of serving it intelligently and constructively an ordinary responsibility. The publisher embraces the opportunity gladly and assumes the responsibility willingly, knowing that the readers of PIT AND QUARRY will give in the future, as they have given in the past, the encouragement and critical help which will make its service the most useful and comprehensive possible.

THE PUBLISHER.

Georgia Lime-Rock Company Produces Material For State Road Building Program

Repetition of Damage and Delay by Flood Last Spring To Be Prevented

By W. E. TRAUFFER

THE LIME rock industry of Georgia, while not yet comparable to that of Florida in quantity of production, is growing rapidly with the increasing number of all-weather highways. The largest market for this material is as a roadbase for asphalt slag or sheet asphalt pavement. This material is a very soft form of limestone of high calcium content similar to Florida lime-rock, which, when laid and thoroughly compacted, forms a very good and durable roadbase as long as it is protected by a waterproof surfacing.

The unusually severe floods of last spring served to awaken the people of the state to the necessity for all-weather roads. When the floods were at their height many towns, both large and small, were partially or entirely isolated and many of the main highways were impassable for weeks. A large road-building program is now under way which will create an increased market for this product.

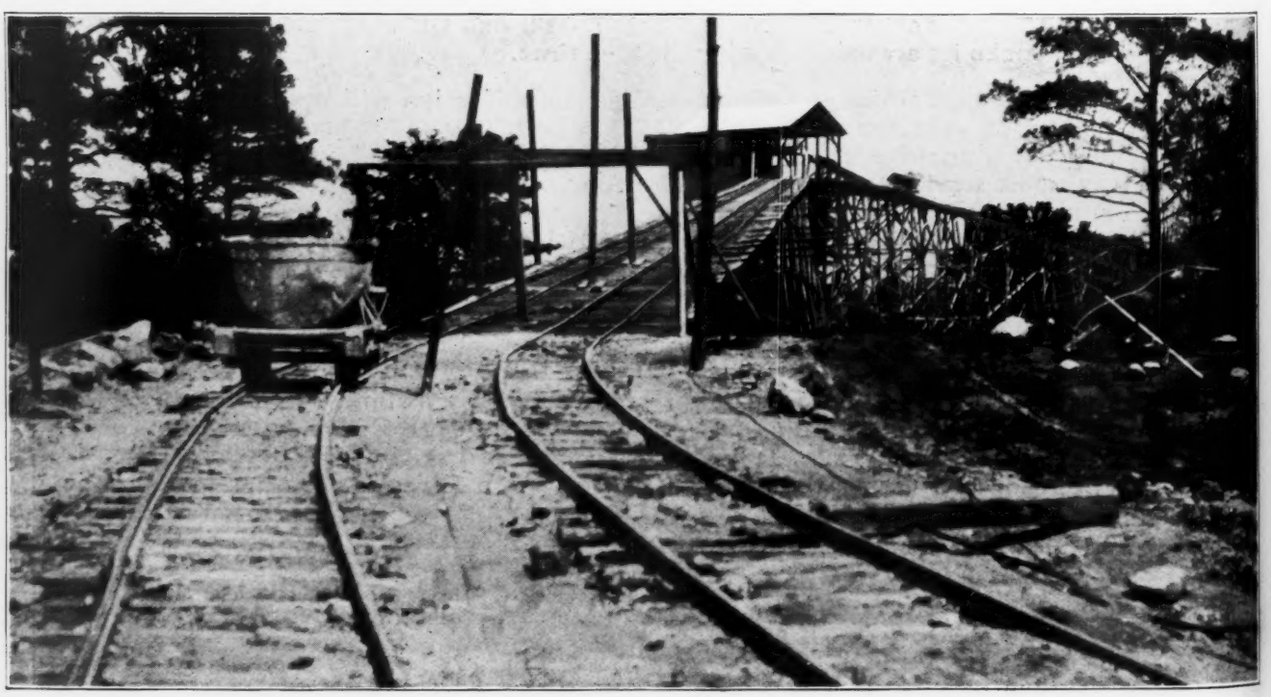
The plant of the Georgia Lime-Rock Company, Incorporated, 4 miles southeast of Perry, Georgia, is now the leading producer of this material in the state. The property consists of about 200 acres of which 60 acres contains lime-rock, mostly outcropping. This stone analyzes from 94 to 96 per cent carbonate of lime and has high cementation value.

The plant, which went into operation on January 1, 1928, has a capacity of about 3,000 tons per ten-hour day. Most of the output is shipped out by rail for use in road work over the entire state of Georgia. Some is also shipped out by truck for agricultural purposes and for local state and county roads.

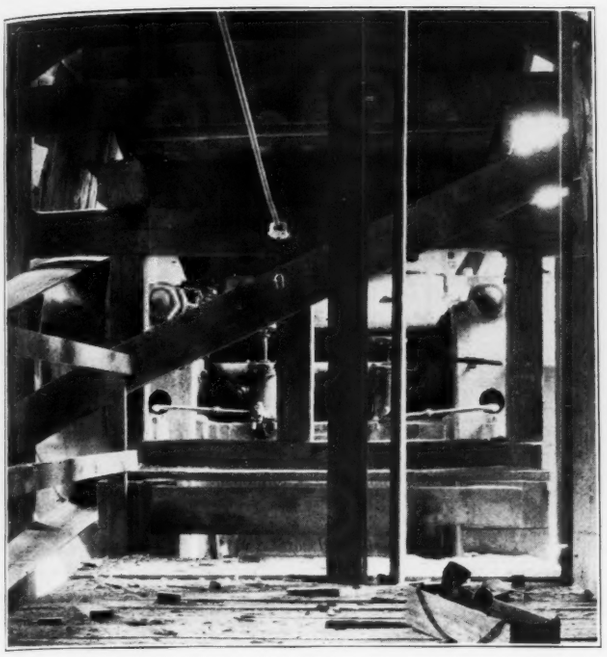
Quarrying Operations

Three pits are now being worked, each having its own incline to the plant. The largest of these is the one south of the plant. The overburden varies from 0 to 2 ft. in thickness and is removed by a P & H gasoline dragline with a 1-yd. Page bucket. This is moved from one pit to another as required.

Drilling is done with a Keystone gasoline driven well drill using a 4-in. bit. The 42-ft. face is shot in single row bank shots of 12 holes using 3 per cent Peerless dynamite electrically detonated. The holes are drilled to the floor level and buffers used to increase fragmentation. Mud-capping, when necessary, is done with Schramm jackhammers, air for which is furnished by a Schramm 5¾-in. by 5-in. two-cylinder compressor mounted on a Fordson tractor chassis, driven by belt from the tractor engine. This outfit is moved around to the various pits as needed.



Incline from west pit and plant



The primary crusher

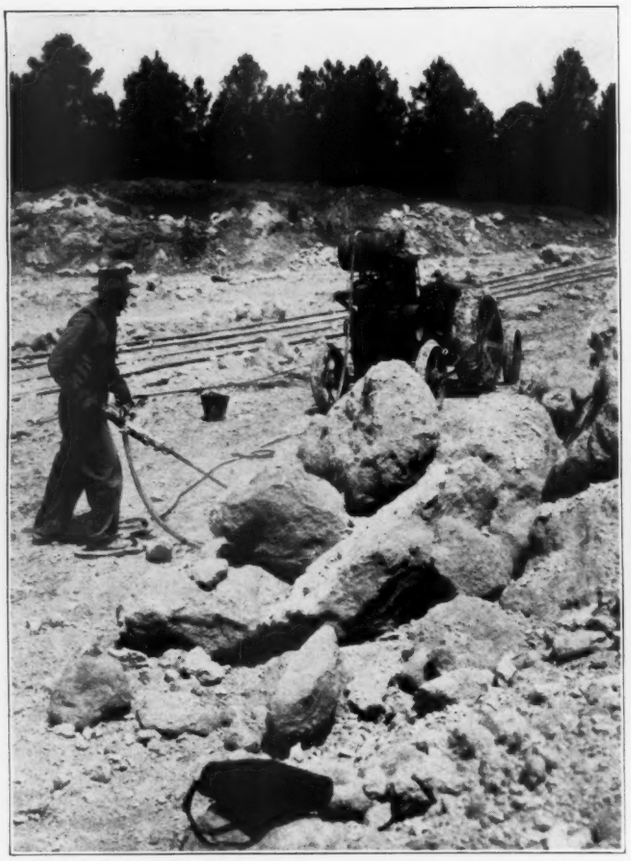
R. W. Hall, cashier (left) and J. M. Tompkins, superintendent

The stone is loaded by an Erie 1-yd steam shovel into 3-yd. end-dump tipple cars on double track, each car being hauled up the double incline to the plant by an individual hoist. The length of haul is about 900 ft., of which 200 ft. is up the incline.

The pit to the west of the plant also has a double incline with individual hoists, using the same type of cars. Another 4-in. Keyestone well drill is used for drilling and blasting is done in the same manner. Another 1-yd. Erie steam shovel does the loading. The haul to the plant is about 1,400 ft., of which 550 ft. is up the incline.

The original pit east of the plant has been worked out and a new one opened farther east. The deposit here is estimated to contain 60 acres of lime-rock with an average depth of 35 ft. Drilling is done by hand and an Erie 1-yd. steam shovel loads into two trains of four Koppel 2-yd. side-dump cars on 36-in. gauge track. These are hauled by a Plymouth 4-ton gasoline locomotive to the bottom of the single track incline to the plant, a distance of about 1,400 ft. A switch track at the foot of the incline allows the cars to be hauled two at a time to the top of the incline while the locomotive goes back for another load. This incline is about 550 ft. long.

View of pit



Portable compressor and drill

The well drill

Crushing and Loading

The five tracks on the three trestles are operated by an Ocala Iron Works hoist with five drums operated by friction from the same line shaft. The cars dump into a steel-lined hopper feeding an Allis-Chalmers 24-in. by 60-in. single-roll crusher, which in turn feeds to a 24-in. by 40-in. Pennsylvania single-roll secondary crusher. A 3-in. bar grizzly over this crusher sends the fines directly into the cars where it joins the crushed oversize material. The oversize discharges from the crusher through a Maddox Foundry and Machine Company sliding gate. The stone can also be diverted through a swinging gate into a chute to a small hopper for loading trucks. All motor drives are by belt, the hoist line shaft being driven by a Westinghouse

View of plant from south showing incline from three pits

Shovel at opening of East pit

South pit with 1-yd. steam shovel loading, mule delivering coal and well drill in background

100-hp. motor, the primary crusher by a 100-hp. General Electric motor and the secondary crusher by a Fairbanks-Morse 50-hp. motor.

Broderick and Bascom and Leschen "Red Strand" cable are used. The sheaves and pulleys were furnished by the Maddox Foundry and Machine Company.

Miscellaneous

A 10,000-gallon capacity wooden tank on the top floor of the building furnishes water for the steam shovels and other purposes. This water is pumped from a 200-ft. well by a deep well pump driven by a Fairbanks-Morse 3-hp. gasoline engine.

The plant and trestle are built of the long leaf yellow pine native to Georgia. The J. S. Schofield and Sons Company furnished the corrugated metal siding and roofing. The entire plant was designed by, and built under the supervision of R. W. Quinn, engineer, of Ocala, Florida. All foundations are of concrete.

The entire plant is floodlighted for night operation, General Electric lights being used. Power comes from the wires of the South Georgia Power Company at 44,000 volts. A substation with 3 transformers reduces the current to 2,300 volts for plant use. Foamite Childs Corporation reversible

Loading cars at plant

View into operating crusher

Dragline stripping in West pit

Locomotive and train of cars

and hand fire extinguishers are used throughout the plant, a considerable saving in insurance being thereby effected.

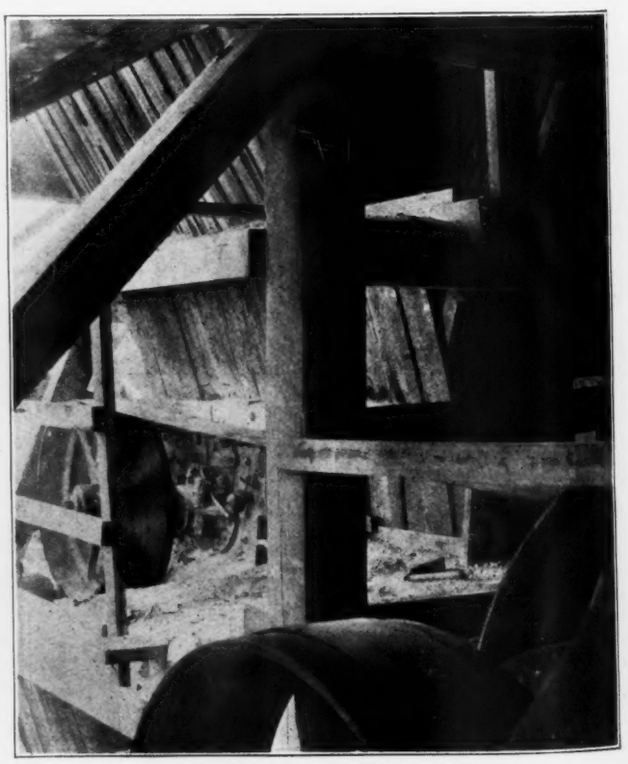
Shipment

Shipments are made over the Central of Georgia railroad. A four-mile switchtrack from the plant, connects up with the twelve-mile Fort Valley to Perry branch. At Fort Valley connection is made with the main line between Macon and Albany over which connections are made for shipment to all parts of the South.

J. M. Tompkins, superintendent of the plant, has had 24 years of experience in the phosphate rock and crushed stone business in Florida. He came to Georgia and prospected and estimated the deposit before the location was decided upon. He maintains his office in a neat frame building a short distance from the plant in which is also a well-equipped commissary for the employes.

The employes number about 75, of whom 20 per cent are white. Some of these live in company houses on the property and some in Perry. These houses are neat frame buildings with electric light, running water and many other modern conveniences.

Car dumping into crusher



Crusher with grizzly above

Interesting Relics

About a year ago a very interesting find was made. While excavating in one of the pits, the vertebrae of a Zeuglodon, a prehistoric whale-like animal, was unearthed at a depth of about 20 ft. The huge skeleton was struck about in the center and was uncovered for a distance of 60 ft. without coming to either end. It will be further uncovered when the pit is enlarged. This discovery aroused considerable interest and several good specimens have been added to the collections of various museums.

Officers

Officers of the Georgia Lime-Rock Company are J. H. Williams, president; W. M. Palmer, secretary and treasurer. Both of these maintain their offices at Ocala, Florida. Willis Callaway, vice-president and sales manager, is in charge of sales at the Atlanta office. J. W. Tompkins is plant superintendent and R. W. Hall is cashier.

The Non-Metallic Mineral Industries Of Illinois*

By J. E. LAMAR, Urbana, Ill.

That Illinois is an important mineral producing state is well known. A value of over $237,000,000 for the mineral products in 1926 indicates the magnitude of the industries. Coal mining is the largest mineral industry, and the value of its product was about 63 per cent of the total mineral production of the state. Oil and gas constituted about 8 per cent and the non-metallic minerals about 29 per cent. This 29 per cent represents the production of a varied group of mineral industries of wide geographic distribution through the state.

The most important of the non-metallic industries of Illinois is the clay and clay products industry. A production valued at over $37,000,000 in 1926 gave Illinois fourth place among the clay-producing and manufacturing states of this country. The industry is widely distributed over the state, due to the wide distribution of raw materials: glacial clays and the clays and shales of Pennsylvanian age. In addition to common brick and tile, which are made in many places in the state, the fire brick industry of La Salle, Greene and McDonough counties is worthy of particular mention.

The limestone industry of the state includes rock for general aggregate purposes, agricultural limestone, railroad ballast, flux, lime, whiting, portland, and hydraulic cement. The cement production in 1926 was valued at over $11,000,000 and comes exclusively from the northern part of the state. The lime produced was valued at over $1,000,000 and also comes primarily from northern Illinois. The crushed rock industry is principally in northern Illinois and along the western and southern margins of the state where upturned beds of Mississippian and older limestones are available for quarrying. The crushed stone produced in 1926 was valued at almost $8,500,000.

The Illinois production of sand and gravel has increased notably in the last few years. In 1926 over $7,000,000 worth of this commodity was sold, giving the state second rank among sand and gravel producers.

The silica sand industry of northern Illinois gave the state first place among producers of silica sand in 1926, production for that year being over $2,000,000. The sand is obtained from the St. Peter formation which is very loosely cemented and is readily disintegrated by blasting or hydraulic mining. Two classes of sand are produced: (1) crude sand, sold after crushing and screening, for steel molding, fire-sand and furnace-sand, and (2) washed sand, which, as the name suggests, is washed. This sand as sold is 99.98 per cent pure silica and is used for making plate glass, as abrasive sand, engine sand, filter sand, and for many other purposes. A special product is the Standard Ottawa sand widely used for cement testing. In 1926 over $500,000 worth of finely ground washed sand was sold, for ceramic purposes, as an abrasive, inert fillers, mold wash, and the like.

Three other non-metallic industries in southern Illinois and one in the central part of the state added over $2,000,000 to the mineral production of the state. The fluorspar deposits in the Mississippian limestones as Rosiclare gave Illinois second place, the fuller's earth from the Cretaceous clays at Olmstead third place, tripoli from the Devonian chert at Tamms and Elco second place, and peat from Mason County also second place, in their respective industries.

* From Mining and Metallurgy.

Uses for Florida White Sand

Florida has always been noted for its abundant supply of clean, white sand. It is being used in many ways, principally for building construction.

A recent editorial in a Florida newspaper said: "Not all who speed along the beaches between Jacksonville and Miami, the finest in the world, know that a dozen or more rare and valuable metals and minerals exist in the sand that purrs under their motor wheels. Considerable quantities of different kinds of metals and minerals are being mined along the Florida beaches and are shipped away. A great amount of Florida sand is also used in construction, the clean, coarse kind being ideal for mixing mortar. The best use for our white sand, however, is for glass manufacture, and the time is not far distant when big factories will be turning out this product from a supply which is unlimited."

Determining the Best Mixtures of Portland Cement by a Graphic Analysis of Its Ingredients

The Best Mixture Has Little Iron Oxide and Somewhat More Alumina Than Is Usually Used

By DR. ERNST JAENECKE*

INASMUCH as the composition of the structural ingredients of portland cement has been established, the question remains whether or not it is possible to base on it any conclusions on the relationship between the quality of the cement and its composition. This is patently possible only when a definite composition of the clinker corresponds to a definite quality of cement made from the clinker. It is known, however, that different qualities of cements can be obtained from the same mixture by varying the manufacturing operations. Hence, it will be assumed in the following that the clinker is made in such a manner that the best result is obtained from a definite mixture. These best results obtained from clinkers of different composition will then be compared with one another. Particular attention must be paid, as is well known, to the mixing, burning and, last but not least by any means, to the grinding operations in order to obtain such cements.

[In the article the author first discusses the various portland-cement mixtures which are used in Germany. Then he describes the various ingredients of the cement that affect its structure and, lastly, he studies the question of the influence that a change in the composition of these various ingredients has upon the quality of the portland cement.—*Trans.*]

The composition of portland cement, based on the ingredients lime, silica, alumina, and iron oxide (this is always Fe_2O_3 unless specifically otherwise indicated), can be represented in graphical form as a tetrahedron. A study of the composition of portland cement reveals the fact that the average composition has not changed for years. Thus, the figures for silica vary between 18 and 25 per cent. The average silica content, therefore, lies nearer the minimum proportion than the maximum. The alumina content varies between 1 and 4.5 per cent, averaging 2.8 per cent. The average lime content is 64 per cent. Only the lime figure has undergone a change during the past few years, due to the manufacture of super-cements. It is, accordingly, figured that the average lime content has increased by approximately 0.83 per cent. The essential difference between the super-cements and the ordinary type of portland cement rests in the fact that the energy of hardening is liberated within a very short time, which is characterized by the great strength of the cement after three days. The final strength is also greater than in the case of ordinary portland cement. This increase in strength is due, however, not only to the change in composition, that is the increase in the lime content, but also to better processing, particularly finer grinding.

*Translated from *Zement*, 1929, pp. 288-292.

Graphic Presentation of the Clinker

The composition of the clinker can be graphically presented by means of a right-angled solid system of coordinates, in which the apex is assumed to be lime, silica being to the right, alumina forward, and iron oxide above. This graphical method is used in this article. If just these four ingredients are taken into consideration, then it is perfectly clear that the percentages obtained from an analysis of the cement cannot be used here without change, for these figures will not, as is well understood, add up to 100 per cent. This must be remembered, for, in recalculating the percentages of these four ingredients of cement on the basis of 100 per cent as their total sum, higher values than actually exist are obtained for each. Thus, if the figures obtained from the tetrahedron graph are to be used as analytical values, approximately 5 per cent must be subtracted from all the given total values, that is the sum of the percentages of lime-plus-silica-plus-alumina-plus-iron oxide.

In constructing the portland-cement tetrahedron, therefore, absolute figures are not employed, according to what has been said, but, besides iron oxide, the ratios of silica to alumina, and silica-plus-alumina-plus-iron-oxide to lime. The second expression is known also as the hydraulic modulus. The limiting values of 1 and 5.5 per cent are chosen for iron oxide. Two planes, parallel to the base plane, are accordingly obtained in the tetrahedron for values of iron oxide equal to 1 and to 5.5. The clinker then lies between these two planes. The ratio, silica to alumina, is equal to a maximum of 1 to 0.48 and to a minimum of 1 to 0.16, according to the mathematical data employed in this discussion. Between these two limiting values will be found the composition of portland-cement clinker. How this is expressed in the tetrahedron must be examined.

A constant ratio, silica to alumina, is expressed by a definite point on the side, silica-alumina. All mixtures which show this constant ratio of silica to alumina are expressed graphically by a plane, which contains the perpendicular line, lime-iron oxide, and passes through this point to the edge,

silica-alumina. The two planes, which correspond to the ratio of silica to alumina are shown in Fig. 1. One of these planes is designated as *Oub* and corresponds to the ratio, silica to alumina equal to 1 to 0.48, and the other is designated as *Omb* and corresponds to the value 1 to 0.16. The composition of the portland-cement clinker lies within this cone-shaped, pointed region. The ratios recalculated on the percentage basis are 33 to 67 and 14 to 86.

In order to limit the field still more definitely, the hydraulic modulus is introduced into the graph. A definite value of the hydraulic modulus is expressed in the tetrahedron by a well defined plane, which has equal segments on the three spatial axes. In constructing the figure, it is assumed that the hydraulic modulus possesses the value of 2.322 as a maximum and 1.79 as a minimum. Calculated on the basis of percentage, these figures correspond to 30 to 70 and 36 to 64. The planes corresponding to both these values, the maximum and the minimum, are constructed. The two planes are designated by *apq* and *brs*, the first corresponding to the ratio 30 to 70 and the second to the ratio 36 to 64. The portland-cement clinker is located between these two planes according to its composition.

The section that is now obtained is a six-sided solid body which is not quite right-angled. It is designated in the figure by *dknglohe*, and within this solid body there lie the mixtures which correspond to the composition of the portland cement. It is clear that the actual composition has varied around an average figure and that a solid body, possessing right angles, does not contain all the mixtures, but that an elliptical figure, drawn within the aforementioned solid figure, contains the limiting values. This elliptical figure is shown in Fig. 1. It comes in contact with the six-surfaced solid figure at six points and possesses almost a spherical outline. That it appears to have an actual spherical form in this case is due to the fact that the scale for iron oxide is increased in ratio to the others and also to the manner in which the figure

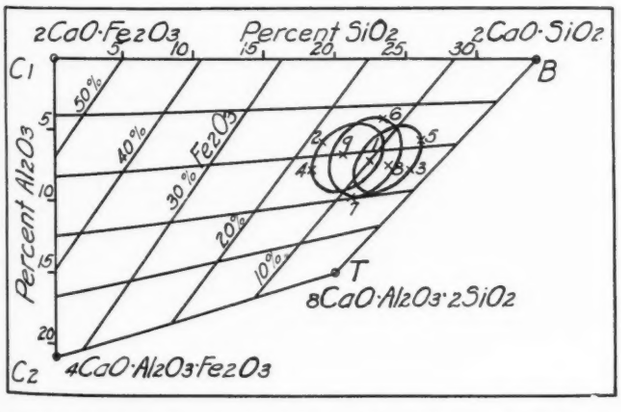


Fig. 2. Location and structural ingredients of clinker

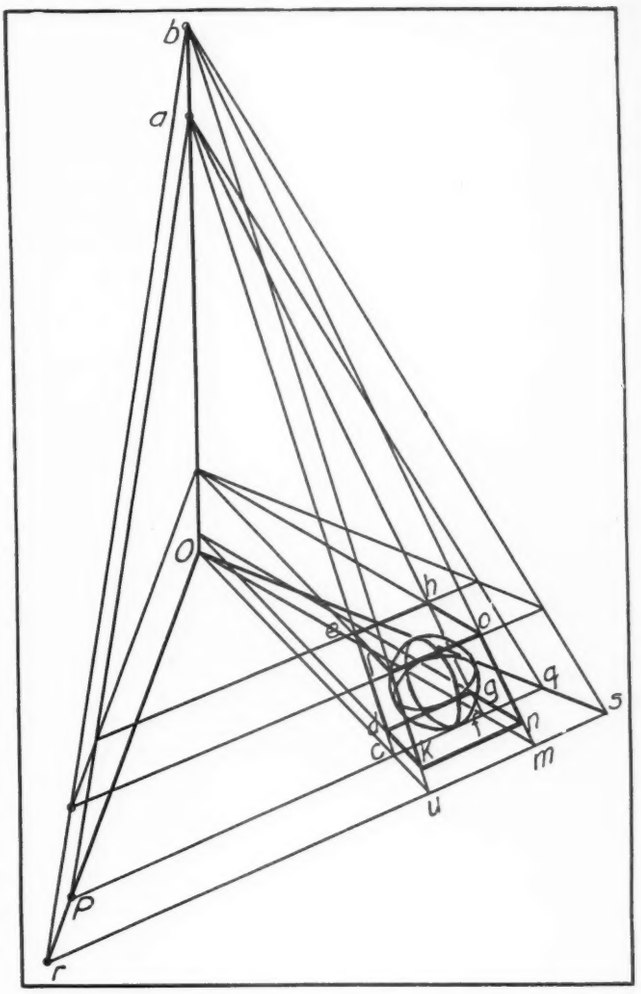


Fig. 1. Location of clinker based on ingredients

is lettered. Horizontal sections are elliptical in form.

Sections of the horizontal planes with these elliptical figures are given for various values of iron oxide in Fig. 2. The following figures are accordingly obtained for the maximum and minimum values of the individual ingredients of the portland cement.

No.	CaO	Percentage by Weight			x y z
		Al_2O_3 (x)	SiO_2 (y)	Fe_2O_3 (z)	$\frac{x}{31}+\frac{y}{35}+\frac{z}{59}$
1 Average value	67.3	7.15	22.3	3.25	0.923
2 CaO, maximum value	70.0	6.4	19.1	4.5	0.829
3 CaO, minimum value	64.2	8.0	25.8	2.0	1.028
4 SiO_2, maximum value	68.9	8.0	18.6	4.5	0.865
5 SiO_2, minimum value	65.4	6.0	26.6	2.0	0.989
6 Al_2O_3, maximum value	68.5	4.5	23.5	3.5	0.875
7 Al_2O_3, minimum value	66.0	10.0	21.0	3.0	0.974
8 Fe_2O_3, maximum value	67.3	7.6	24.1	1.0	0.951
9 Fe_2O_3, minimum value	67.4	6.7	20.4	5.5	0.892

It must be explained that the above figures do not give directly the analytical composition of the clinker, for the reason that all other ingredients outside the four mentioned are omitted. In order to determine the actual values of the maxima and

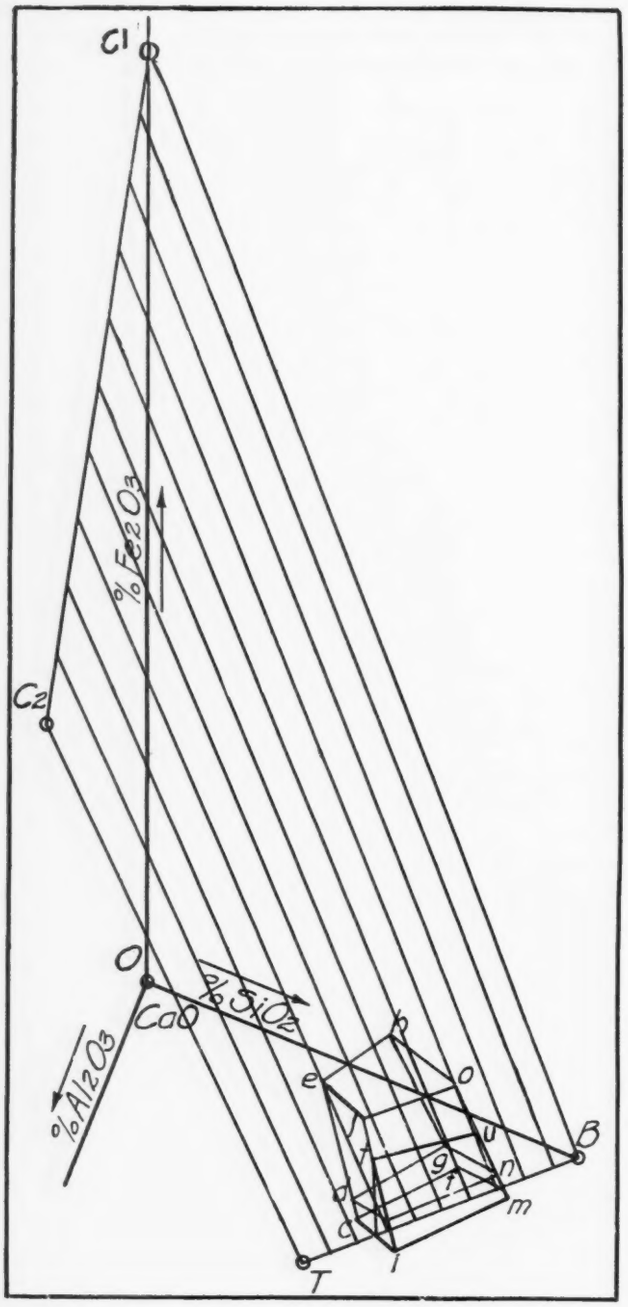


Fig. 3. Spatial diagram of structural ingredients

minima and of the section as they are found in analysis, it is necessary to decrease all the figures by a certain percentage, which is approximately 5. We do not intend to go into any greater detail at this point, as far as the figures in the last column of the above tabulation are concerned.

The Structural Ingredients of the Clinker

The structural ingredients of portland-cement clinker can now be considered as established as follows. The iron-free ingredient, which has been called alite, is in the form of mixed crystals of the compound J equal to $8CaO.Al_2O_3.2SiO_2$, and B equal to Beta-$2CaO.SiO_2$. When the mixed crystals are separated from one another, they are found to have a characteristic melting diagram (see Fig. 4). Both components B and J are not congruently fusible as such. Beta-dicalcium silicate is formed after the solidification of the alpha-dicalcium silicate at a temperature of 1,970 deg. C. The compound $8CaO.Al_2O_3.2SiO_2$, for which the name jaeneckite has been proposed, melts likewise non-homogeneously. When a liquid melt of this composition congeals, lime is first separated out at a temperature of approximately 1,960 deg. C. and the compounds are formed first thereafter. Although mixed crystals are formed in all proportions between these two compounds, it is because of the characteristic behavior of the compounds in melting and congelation that both compounds exist in the presence of each other. Furthermore, it is often possible to observe dicalcium silicate as such in addition to the mixed crystals. Beta-dicalcium silicate is, of course, the well known belite.

In addition to these iron-free mixed crystals, which form the portland-cement clinker, there is a series of iron-containing mixed crystals, which are represented in the so-called celite of the clinker. Investigation has shown that there are two compounds, namely $2CaO.Fe_2O_3$ and $4CaO.Al_2O_3.Fe_2O_3$. These crystallize isomorphously. The alumina-free compound melts non-homogeneously at a temperature of 1,435 deg. C and the alumina-containing compound melts homogeneously at a temperature of 1,415 deg. C.

There are, therefore, essentially two kinds of mixed crystals which constitute the ingredients of clinker. These are known as celite and alite. The gravimetric ratios based on the four principal ingredients of the clinker are seen in Fig. 3 in the same manner as in Fig. 1. The compounds which have been mentioned above are indicated in the figure as points. The compound $2CaO.SiO_2$ lies at the point B, the compound $8CaO.Al_2O_3$ at the point J, the alumina-free compound $2CaO.Fe_2O_3$ at the point C_1 and the alumina-containing, iron-free compound $4CaO.Al_2O_3$ at the point C_2. A surface is obtained by connecting these four points by straight lines. This surface is nevertheless not a plane surface for the reason that, when the straight line BJ is prolonged up to the lime-alumina axis, a point is obtained which is not the same as when the straight line C_1C_2 is also prolonged to this axis. The designated surface is therefore an oblique plane. On it are found all the mixtures which are constituted of alite and celite, and it should be mentioned that a definite mixture also represents the equilibrium between a definite iron-containing mixed-crystal celite and a definite iron-free mixed-crystal alite.

In order to express this condition, straight lines connecting the various points in the straight lines BJ and C_1C_2 are drawn, and then BC_1 and JC_2 become the limiting lines. The fact that the mixtures that lie on this plane in accordance with their com-

position are actually constituted of two structural constituents only can be determined by microscopic examination.

It appeared to be proper to investigate this matter more in detail. However, microscopic examination of the mixtures was rendered difficult due to the intensive coloration produced by the iron compound. A thermal investigation would not be difficult in the case of iron-rich mixtures, but it possesses little interest for the reason that just these mixtures are not found within the practical limits of a portland-cement clinker. When only the iron-poor mixtures are considered, then their composition may be represented in percentage as follows, x per cent silica, y per cent alumina and z per cent iron oxide; and these percentages may be interconnected in an equation which will give the relationship between them with considerable accuracy. This equation is as follows: $\frac{x}{(35)} + \frac{y}{(31)} + \frac{z}{(39)} = 1$. The percentage by weight of lime is then found from this equation to be equal to $100\text{-}x\text{-}y\text{-}z$.

Fig. 3 also contains a construction which represents the average composition of the portland cements made in Germany during the past twenty years. It is found by calculation that the sum of all the values, x, y and z (with the exception of one), is less than unity, averaging 0.93. The inference is that these portland cements contain 7 per cent of alite and celite.

Clinker Properties and Composition

The relation between the properties of the clinker and its composition must be studied on the assumption that the best possible clinker is manufactured from each mixture according to the best method. It is not possible to make any statements regarding this relationship, except those of a very general nature, without first carrying out very thorough investigations. The first study that will be made is concerned with the manner in which the properties of alite as a mixed crystal can change in accordance with its varying composition. This compound can be prepared from a mixture of the compounds B and J. However, a mixture is no longer present after it is made, but a mixed crystal of B and J. The properties of a simple mixture generally lie between the properties of the two ingredients from which it is prepared. This, however, is not absolutely necessary. There can be, for example, a mixture which may be better in a certain property than the best of the two ingredients. However, in the case of mixed crystals the properties are generally not expressed as a straight-line relation lying between those of the two ingredients. There are very many cases where the properties of definite mixed crystals are better than those of the best ingredient.

The manner in which the properties of mixtures of the two ingredients J and B can vary when mixed crystals are formed is shown graphically in Fig. 4. The values of the properties are plotted as ordinates and the curve shows that the best effect is obtained in the case of a mixture which lies nearer to J than to B. Somewhat more analagous is, morever, the case for strength characteristics of mixtures of B and J. It is found that the best strength properties are obtained with a mixture which contains more of the J compound than of the B compound.

The iron-containing compounds C_1 and C_2, which constitute celite, also possess hydraulic properties, which are, however, less potent than those of the iron-free compounds. The same general conditions as expressed above for B and J serve also for mixed crystals of C_1 and C_2. These are, however, not of much interest. The question may now be asked as to the manner in which the hydraulic properties of the mixture of mixed crystals of celite and belite vary. The properties of the mixtures which lie on the straight lines joining definite points B, J, C_1, C_2 must also be determined. It is perhaps possible that the addition of an iron-containing compound to the iron-free cement improves the hydraulic modulus of the latter to a certain extent, but it has been found from actual experimentation that the improvement is very

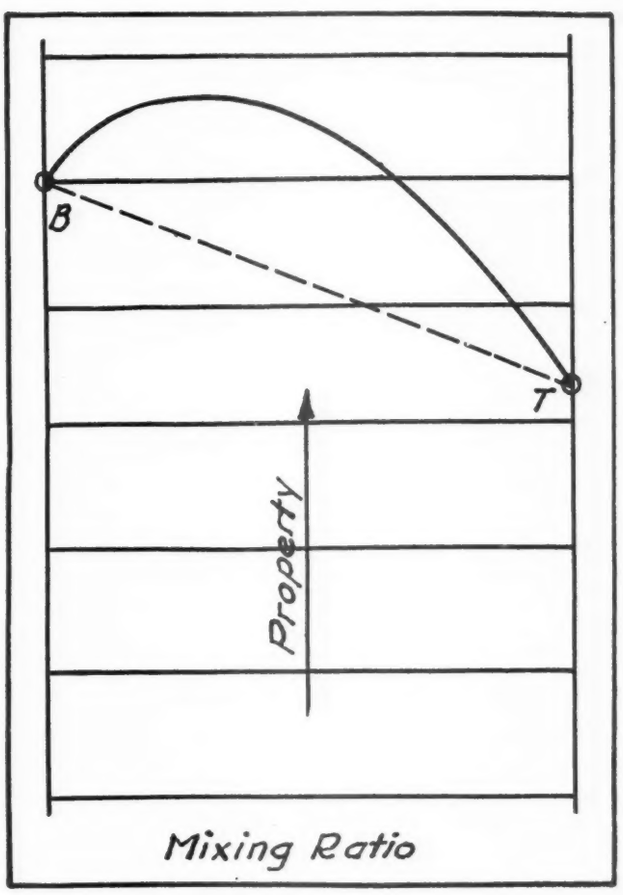


Fig. 4. Properties of mixed crystals of substances

limited in scope and that whatever improvement is obtained can be secured by the addition of a small proportion of the iron-containing compound. Hence, cement clinkers of still better hydraulic characteristics can be obtained. The cements lie in the figure in the neighborhood of the straight lines B and J on the plane surface JBC_1C_2. They contain a small proportion of iron.

The exact representation of this condition is naturally very difficult due to the fact that it must be concerned with "chemically pure portland cement." The author's opinion is that the properties and quality of the portland cement are in themselves not essentially improved by the addition of the iron-containing compound, so that, as far as the composition of the cement is concerned, a gradual decrease in the hydraulic properties exists on the straight line from alite to celite. The addition of iron has principally the very essential action of bringing about more readily an equilibrium between all the compounds, including the iron-free compounds. This is caused by the reduction of the melting temperature due to the presence of iron.

It still remains to be mentioned what influence lime—which is present in the clinker, according to what has been said above, to the extent of several per cent—has on the cement as far as its hydraulic properties are concerned. We should also discuss here whether or not the addition of a substance such as lime, possessing less potent hydraulic properties, to alite, which possesses potent hydraulic characteristics, can improve the properties of the latter. In this instance the author would like to state that he believes that the presence of lime in excess will also improve the properties of the alite. Lime is not generally considered a structural ingredient of portland-cement clinker. However, as can be deduced from what has been said above, it must be such an ingredient within a limited scope. Its proportion in the cement is, to be sure, small and amounts to only a few per cent, so that it should not be thought remarkable that it escapes observation for the most part in an examination of portland-cement clinker.

The Best Mixture

The author subscribes to the opinion that when the proportion of iron oxide in the portland-cement mixture is small and when the alumina content is perhaps somewhat greater than the average proportion found in the portland-cement clinkers made to-day, the best mixture is obtained under such conditions. The ingredients of the clinker may be expressed in a certain sense by the following equation: $\frac{x}{31}+\frac{y}{35}+\frac{z}{59}=0.95$. In this equation the symbol x stands for the percentage by weight of alumina, the symbol y for the percentage by weight of silica, and the symbol z for the percentage by weight of iron oxide, when these values, together with lime, amount to 100. When the straight analytical figures are used, the above equation then assumes the following form: $\frac{x}{31}+\frac{y}{35}+\frac{z}{59}=0.9$.

If the symbol w is used to denote the percentage by weight of lime, then the following equation may be written: $w=95-x-y-z$. If, for example, the value of z is assumed to be 2 and that of x 8 per cent, then the above equation will give 21.3 per cent as the value for silica and 63.7 per cent as the value of lime.

If this assumption be correct, then a clinker which has the composition 63.7 per cent lime, 21.3 per cent silica, 8.0 per cent of alumina, 2.0 per cent of iron oxide and 5.0 per cent other ingredients, would be the best.

If the alumina content were larger—that is, approximately 10 per cent of alumina and 2 per cent iron oxide—then, in accordance with the above equation, the content of silica would be 19 per cent and that of lime 64 per cent.

Both figures agree well with practical observations. However, whether or not these figures prove correct can be determined, as has been shown above, only by a detailed investigation. It is perhaps possible that there are sufficient statistical data of wide scope in existence which could be used to arrive at a definite conclusion on this matter. In carrying out such a study the strength figures must be considered with respect to their relationship to the composition of the portland cement. Furthermore, only the best values of a certain accurately defined mixture must be used. If a large proportion of the tests are tabulated in accordance with the iron content of the portland cement, approximately by increments of 0.5 per cent, then the strength value—that is, the bursting strength—of each mixture investigated could be represented as a point in a system of coordinates wherein the percentage by weight of silica was used as the abscissa and the percentage by weight of alumina as the ordinate. Like strength values would have to be connectible in the form of a curve, so that it would be possible to determine for each series a mixture that would possess the greatest strength. It appears possible that laws concerning the quality of cements could be deduced from such an investigation, although the tests would be made on products which are not chemically pure clinker, that is, clinker that contains no other constituents besides lime, alumina, silica, and iron oxide. Other properties of the clinker could also be investigated statistically in the same manner.

Operation of the Corson Pennsylvania Lime Plant Has Continued More Than a Century

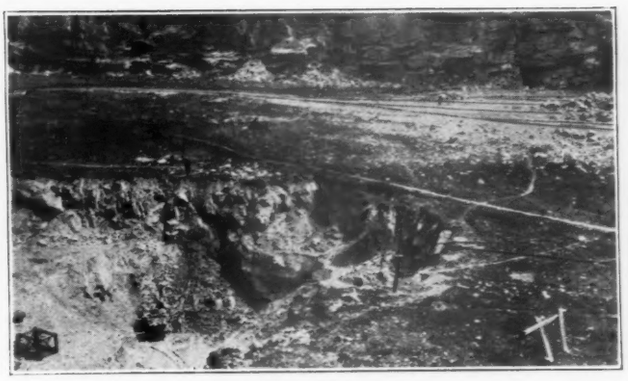
Efficient Methods and New Equipment Keep the Plant Modern in Every Respect

By F. A. WESTBROOK

THE lime business of G. and W. H. Corson, Incorporated, Plymouth Meeting, Pennsylvania, has been in the Corson family since 1824. The unusual name of the community, Plymouth Meeting, is derived from the ancient stone Quaker meeting-house around which it grew up and which was used as a hospital during the Revolutionary war. It is only a few miles from the historic Valley Forge. Of course many changes have taken place in lime burning during the long time that the Corsons have been in business, but it is evident that this old Quaker family which received its original grants of land from William Penn is progressive, for the present operation is a model of efficiency and well-planned layout.

Phillip Corson is now in charge of production and his brother, Bolton L. Corson, is responsible for sales. A third brother expects to take an active part in the business as soon as his college education has been completed. The fourth generation of Corsons in the business certainly has reason to be proud of its plant.

This operation, like others in the district, is most fortunate in being located within easy reach of the Philadelphia market. It is actually only a mile and one-half from the city line. Consequently all lump lime is shipped in bulk, either by trucks direct to the job or in freight cars. Barrels are not used at all. Other products are shipped with equal economy.



New low level in Corson quarry

These other products are hydrated lime which is shipped in bags, flux stone, crushed stone, and a mortar material called Corsonite, also shipped in bags and especially developed by this company. It is a plastic, non-efflorescent, waterproof material of great strength and bonding power, having a tensile strength of 90 pounds to the square inch at seven days, when mixed with three parts of sand by weight.

Quarry

Stripping is done with an Osgood steam shovel and the material is carried away in trucks so that

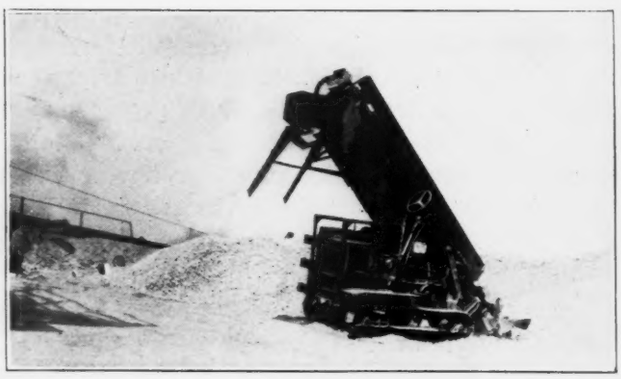
General view of Corson plant

Stone crushing plant

it will not have to be moved again as the quarry is extended. At the present time, the depth of the quarry is being increased and worked on two levels.

Gehret side-dump quarry cars are used and give good service. Their tracks have been laid in the quarry with a slight decline from the working face to the foot of the incline to the kilns so that when loaded, they will cover this distance by slow gravity coasting. The empty cars are hauled by horses. Some 500 tons of rock per day are taken out in this way.

An incline extends from the floor of the main



Loader at crushed-stone storage pile

quarry to the top of the kilns, with a branch to the new lower level. The cars are hauled up this incline by a Lidgerwood electric hoist. An Orr & Sembower hoist is available for this service but is held in reserve for use with only a few minutes' delay. As Phillip Corson explains, a steady flow

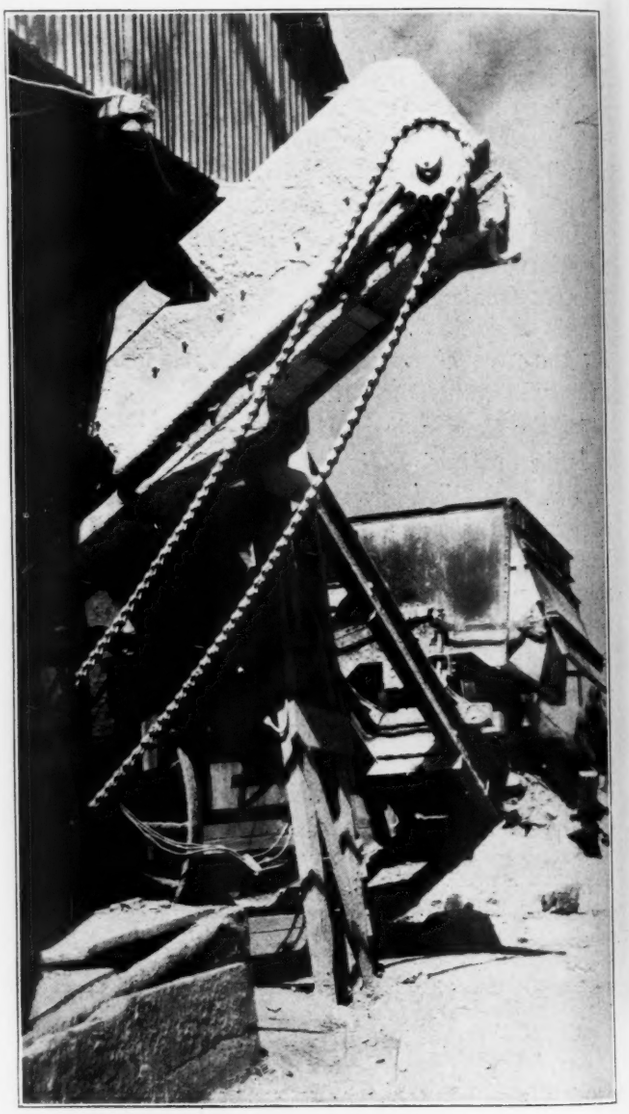
Incline to top of lump lime storage bins

of stone from the quarry is so important that emergency stand-by equipment is desirable and it has, in fact, saved the day on more than one occasion.

The main drilling is done by contract with well drills. For the secondary drilling there is a 10-in. by 8-in. Ingersoll-Rand compressor which supplies air for the Ingersoll-Rand jackhamers.

Crushing Plant

A considerable amount of crushed stone is sold for road work in the Philadelphia area. Spalls and



Conveyor for loading lump lime in bulk

low-grade stone from the quarry are used for this purpose. This material is brought up the incline from the quarry in the Gehret side-dump cars. About one-third of the way up this incline, between the top of the quarry and the kilns, two hoppers and chutes have been constructed on opposite sides of the track into which the cars may be dumped.

On one side the chute leads direct to a freight-car siding. This is used mainly for loading flux stone. The chute on the other side leads to a Cham-

pion jaw crusher. A Good Roads Machinery Company elevator carries the stone from under the crusher up to a revolving screen of the same make. The latter separates out the 1½-inch stone. The tailings are returned to the crusher through a chute and the sizes under 1½-inch pass by gravity to a Link-Belt double-deck vibrating screen which removes the ¾-inch, ¼-inch, and sand. The general arrangement of this machinery and bins is shown in one of the illustrations.

Dump-car at draw-off chute beneath kiln

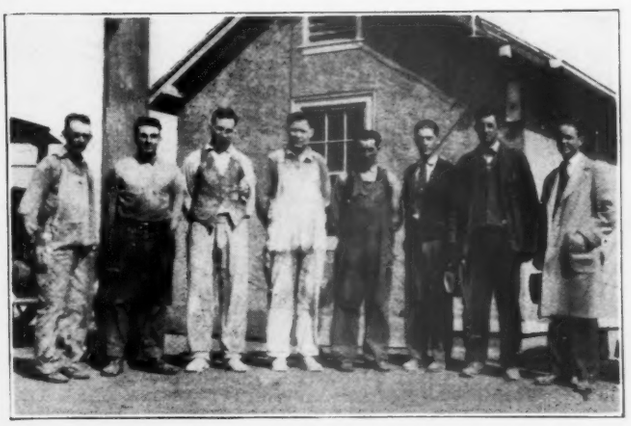
When the stone-storage bins are full, surplus-storage piles are made with a Clark truck tractor and, from these piles, trucks are loaded with a Haiss loader. Practically all shipments of crushed stone are made by trucks provided by contractors.

Lime Burning Plant

Lime is burned by the Eldred process in six Arnold-Weigel kilns. As a result of experimentation, these kilns have been provided with interesting special equipment. They have been capped and provided with the high stacks that show conspicuously in the general view of the plant. These high stacks,

Stripping with steam shovel

by increasing the velocity of the gases, causes the heat to be transferred more quickly to the contents of the kiln as they are recirculated by the Eldred process, without overheating the stone. A high fuel ratio has been obtained. Also the bottoms of the kilns have been provided with specially designed sliding gates to facilitate the drawing of



Part of plant personnel. Philip L. Corson at right, Clarence Fulmer, superintendent, second from right

the burned lime. They are operated from a rack-and-pinion by means of a chain-and-sprocket which has proved effective in obviating loss of time through jamming.

The burned lime is drawn into bottom-dump cars which are hauled directly from the kilns up an incline to the top of the 150-ton steel lump-lime storage tank by a Lidgerwood hoist. At the bottom of

Truck tractor dumping crushed stone

East side of quarry, showing tracks to foot of incline

the incline is a Streeter-Amet automatic weighing and recording machine which keeps a record of all the burned lime. The workmen in this department —some of whom have been with the company forty years—are paid on the basis of the amount of lime as recorded by this machine and Mr. Corson explains, with much satisfaction, that since its installation the earnings of the men and the production of the plant have been very substantially increased. Also their morale is much improved.

The engineering for the lump-lime storage tank and handling equipment associated with it was done by the Link Belt Company and the Robert L. Latimer Company. At the bottom of the storage tank the lime is drawn onto a Link-Belt belt conveyor which delivers it to a shaking screen. The lumps from this screen are delivered to a Link-Belt conveyor where they are picked over and then pass to a Link-Belt box-car loader which may be used also to load trucks.

The fines from the shaking screen are carried by a Link-Belt screw conveyor to a Walker-Elliott crusher.

Hydrating Plant

The ground lime—which of course may be sent by the conveyors to the above-mentioned crusher direct from the lump-lime storage tank without having the lumps removed by the shaking screen—is next elevated on a Link-Belt elevator to the concrete storage silo; or the same elevator may deliver it directly to the steel tank which feeds the Clyde hydrator. When ground lime for hydrating is drawn from the storage silo it is carried on a Link-Belt conveyor to the same elevator which delivers it to the tank over the hydrator.

From the hydrator the lime passes by gravity to the Raymond pulverizer and then by a chute to the No. 11 Raymond exhauster-separator. This machine has been equipped with an Allis-Chalmers Texrope drive which, by the elimination of slippage due to the dusty condition of the atmosphere, has increased production possibly 10 per cent, according to Mr. Corson.

From the separator the ground hydrated lime passes into the tanks over the two Bates valve-bag packers. One of these tanks has been tapped to feed into a Broughton mixer, when desired, for the preparation of Corsonite, described at the beginning of this article.

As will be seen from some of the illustrations, railroad spurs have been provided for convenience in shipping. There are two sidings on the Reading Railroad and one on the Pennsylvania. There is a twenty-ton Standard track-scale.

Grinders of Feldspar Organize An Institute

Officials of companies engaged in the grinding of feldspar have organized the Feldspar Grinders' Institute, Incorporated, with headquarters in New York City. The purpose of this new organization is to foster cooperation and other friendly relations among its members as well as between its members and the trade.

The officers of the institute are: President, J. Alfred Dennis, of Golding-Keene Company, Keene, New Hampshire; vice-president, H. P. Margerum, Consolidated Feldspar Company, Trenton, New Jersey; secretary-treasurer, L. L. Hunt, Bedford Mining Company, Bedford, New York; and directors: C. H. Peddrick, Jr., United Feldspar Corporation, New York, New York; Richard Wainford, Trenton Flint & Spar Company, Trenton, New Jersey; Norman G. Smith, Maine Feldspar Company, New Brunswick, Maine; H. G. MacLear, Green Hill Mining Company, New York, New York; W. J. Parker, New York, New York.

The directors have elected Mr. Parker as commissioner of the institute with offices at 7 East 44th Street, New York City. He has had years of experience in trade-association work and will endeavor not only to fulfill the purpose of the institute but also to improve the industry as a whole.

New York Crushed Stone Association Meets

Trout Brook Inn, Barneveld, New York, was the scene June 27 of a meeting of the New York Crushed Stone Association, presided over by President James Savage.

W. L. Sporburg read a letter from J. R. Boyd, secretary of the National Crushed Stone Association, requesting that more accurate tonnage figures be furnished the national body for correcting its production statistics.

It was unanimously decided that the next meeting of the New York association should be held at Boice Hill Farm, Churchville, New York, where the members will be the guests of the Genessee Stone Products Company.

The question of the national association's next meeting place having been raised by Otho M. Graves, the members decided on New Orleans as first choice and St. Louis as second choice.

The Problem of Lubrication in the Light of Modern Theories and Recent Laboratory Research

Temperature—Low, High, and Atmospheric—Divides Investigators Into Three Groups

By R. N. PATCH*

WE STUDY lubrication for the purpose of learning the best way to prevent the seizing and wearing away of metallic surfaces which have motion relative to one another. The problems of lubrication are so wide and varied that we have one group of investigators studying lubrication at elevated temperatures and another group studying the problem at low temperatures. There is still a third group investigating the conditions at normal atmospheric temperatures or at temperatures slightly above these. Each field of research is equally important to a wide and growing number of users.

It has come to be pretty generally recognized that there are two more or less distinct kinds of lubrication. These are known either as "boundary" or "solid-film" lubrication on the one hand, and "viscous" or "fluid-film" lubrication on the other. Let us consider for a minute the conditions existing when two clean metallic surfaces are placed together or are in contact with each other. The molecules on the two surfaces tend to attract each other and, under conditions where a large force is exerted, the phenomenon of "seizure," or welding into a continuous solid, results. In other words, there is indication that a force of cohesion must be operating.

Of course, we also know that on the surface of all metals there is an electromagnetic field; in other words, there exist forces capable of attraction and repulsion. In the practice of lubrication, therefore, the endeavor is to introduce an oily film between the metal surfaces in such a manner that the electromagnetic forces become saturated, and therefore correspondingly diminish the force of cohesion. Suppose, for instance, the rubbing surfaces have a very thin film of lubricant between them; then we have an absorbed film allowing the two solids to move over one another with greater ease because of the greater elasticity of the molecules of the film. Under these conditions "boundary" lubrication is said to exist.

As the layer of lubricant becomes comparatively thick, there are numerous layers of molecules of the lubricant which are outside the range of the attractive forces existing on the surface of the metal. Then, under these conditions, as the force is applied, the resistance to the promotion of motion of the surfaces relative to one another becomes that of the internal friction of the lubricant layers. It is, therefore, proportional to the viscosity of the oil. Under such conditions one has "fluid-film" lubrication.

It follows, therefore, from what is above stated, that we may have a lubricant which is capable of neutralizing the attractive forces on the surfaces to a large extent, and we have a good "boundary" lubricant. Recent research has indicated that, under "boundary" conditions, the friction is largely a function of the chemical constitution of the lubricant and of the nature of the solid surfaces.

Function of a "Boundary" Lubricant

The work of Harkins and Langmuir in this country and that of Sir W. T. Hardy in England lead to the conclusion that the function of a lubricant in "boundary" lubrication is connected with its adsorption at the metallic surface and, further, that this adsorption is due to forces which cannot be distinguished from chemical affinity. Moreover, those parts of a liquid lubricant which possess the most residual or free chemical affinity are directly adsorbed and orientated; *i. e.*, caused to take up their position towards the solid surface, and the film produced is of the order of one molecule in thickness.

The work of certain investigators appears to show that a very small quantity of fatty acid—up to, say, 1 per cent—added to a mineral lubricating oil has a marked effect in improving the lubricating power of the oil. The researches on this subject were first conducted by Wells and Southcombe, and later supported by Deeley, J. H. Hyde and Stanton of the National Physical Laboratory in Great Britain, as well as by Wilson and Barnett of this country. Apparently this property is not strictly confined to acid substances, but also applies to other compounds having radicals containing oxygen, such as fatty oils. Some ten years ago Dunstan and Thole showed that mineral oils composed of the more unsaturated type possess "oiliness" to a greater degree than others, but in no case was the efficiency of the mineral oils, as a class, equal to that of the fatty oils in "boundary" lubrication.

The X-Ray, which has been used to help solve many a knotty problem in other scientific fields, has now been applied to the investigation of this

*Research Staff, E. F. Houghton & Company. Article reprinted from that company's *Black and White*.

phase of lubrication. J. J. Trillat, in his "Modern Theories of Lubrication," describes investigations carried out in studying the action of fatty acids in contact with metal plates. Those of us who remember our organic chemistry will recall that the characteristic grouping of a fatty acid is the COOH or carboxyl group. One obtains spectra by the use of the X-ray in which it would appear that the acid grouping above referred to takes root in the metal, and that there is formed a very thin layer which is in the nature of a stratified structure very similar to that of a pack of cards. It has been found that similar conditions exist whether one has a mineral oil in which free acid is present or an oil in which a fatty acid has been dissolved.

Therefore, in place of the electromagnetic field formerly existing on the surface in a bearing, adjoining or in contact with the other metallic surface, we find that the field is to a large extent neutralized by the taking root on the surface of the acid grouping. The result is that above the stratified structure we have a surface covered with the balance of the organic acid or the hydrocarbon part of the molecule. The strata slide over each other very easily with little or no friction, but, on the other hand, resist attempts to deform them in other directions just as a deck of cards would. The affinity of the active portions of the acid for the surface of the metal explains similarly the resistance to all attempts to tear them and thus expose the bare surface of the metal.

The Action of Triglycerides

It has been found also that fatty acids were not the only bodies which exerted this powerful action, but that other materials, such as the triglycerides, of which a fatty oil is an example, also underwent a rearrangement of structure. However, it was found in these instances that the adhesion was not a chemical one, but a physical affinity. The molecules of the triglycerides are described as, or compared to, a three-compartment suitcase, in which the active part is a glyceric radical which attaches itself to the surface of the metal, while above it the fatty-acid residue is arranged just as the hydrocarbon portions in the case of acid. Thus, we may illustrate structurally the triglyceride as:

$$\begin{bmatrix} CH_2 - OR_1 \\ | \\ CH - OR_2 \\ | \\ CH_2 - OR_3 \end{bmatrix}$$

The glyceric radical and its similarity to the three-compartment suitcase is indicated by that portion which is boxed. The symbols OR indicate the fatty-acid residue, which may be the same or different acids. In other words, in so far as the X-ray studies were concerned, it would appear that oiliness was due to the ease with which the bodies rearranged themselves and took up a stratified structure of the kind described above.

Trillat has come to the conclusion that oiliness is a latent property brought out by external physical agencies such as pressure or friction.

In a paper on "Petrol Engine Lubrication" C. I. Kelly draws an illustration of the two types of lubrication from consideration of a simple journal bearing. "When motionless, the journal and bearing surfaces are in contact; at least they can only be separated by a film of oil of extremely small thickness. When the journal starts rotating, the friction, being of the 'solid' type, will be high. As soon as a very thin film of oil gets between the surfaces the friction will be reduced and will be least with lubricants composed of fatty acids because of their low coefficient of friction when in the thin-film condition. A hydrocarbon oil containing a small percentage of the higher fatty acids will function almost as well, because the fatty-acid molecules concentrate on the bearing surfaces. As the oil film thickens, the friction will depend upon the viscosity of the oil at the working temperature.

"As the journal revolves, the oil film is established by the dragging action of the surfaces. As the speed of rotation increases, the journal is lifted and floats on a thick oil film. The dragging action also develops a pressure in the film (there is a flow of oil through the ends of the bearing surfaces). When a thick film is established, the 'fluid-film' conditions cause the friction to drop to about a one-hundredth part of the friction existing during 'boundary' conditions.

"Fig. 1 illustrates the disposition of the journal and bearing when running under load. The point of nearest approach is not vertically below the center of the journal but to the off side of the bearing. The change in pressure in the oil film from point to point is important. At *PM* the pressure is at a maximum and at *Pm* at a minimum. These points would have to be borne in mind when selecting a spot for oil-feed holes and grooves.

"The importance of a study of the two types of lubrication is clear when one remembers that the surfaces are subject to 'boundary' lubrication when they are about to come to rest and when they just begin to move. The crankshaft main bearings and big-end bearings suffer some wear immediately

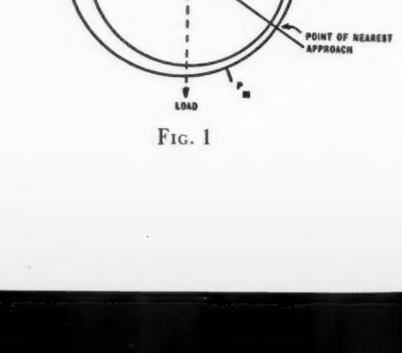


FIG. 1

after starting the engine and when it is coming to rest, but in the case of the piston the change from one type of lubrication to the other takes place every time it reaches top and bottom dead centers. This does not apply to sleeve-valve engines, because the piston and the sleeve always have relative motion, even though the piston has to come to a state of rest in a vertical plane."

From all the above it is seen that we have conditions to overcome in lubrication at the surfaces where there is 'boundary' lubrication different from those in cases where the surfaces are entirely separated, and where we have fluid or viscous lubrication, just as in the study of the flow of liquids through pipe lines, or in the study of heat-transfer effects. For here, also, we have conditions existing at the metallic surfaces different from those in the interior of the pipes, all of which must be duly considered in engineering problems.

Lubrication at Low Temperatures

At the round-table discussion on lubrication, held in St. Louis in the spring of 1928 at a joint meeting of the petroleum, industrial and engineering chemistry divisions of the American Chemical Society, a report was made on the results of experiments carried out on lubricating automobile equipment at low temperatures. The work was undertaken for the purpose of determining and studying the effect of viscosities of typical automotive lubricating oils at zero temperature, as well as the effect of the pour test upon the resistance to cranking offered by the oil and upon its circulating characteristics. The results indicated that cranking effort is determined almost entirely by the viscosity of an oil apart from its cold test, while circulation by the lubricating system depends largely upon the temperature of the oil being above its pour test.

The statement was made that "two oils may have the same viscosity at 100 deg. F. (38 deg. C.), but entirely different properties at 0 deg. F. (-17.7 deg. C.). The paraffin-base oil, for instance, although having a comparatively high pour test, actually flowed more readily at high rates of shear than did the asphalt-base oil. In other words, while the paraffin-base oil had the higher apparent viscosity at low rates of shear, this condition was reversed at high rates of shear." Furthermore, tests on the oil circulation show that the pour test was the factor in determining the establishment of circulation, at least with the type of oils used. It was virtually unaffected by viscosity characteristics and high-shear stresses.

It was further stated that "unfortunately the types of crudes which yield oils possessing a low temperature coefficient generally tend to give rather high pour tests, and, conversely, those oils which naturally have low pour tests also have very large viscosity-temperature coefficients. Since a low temperature coefficient of viscosity is of more fundamental importance at both low and high temperatures, it appears logical to emphasize this characteristic and to eliminate or minimize the objection of pour tests by enlarging the pump inlets, which would also help to eliminate clogging by the ice crystals. An oil with both characteristics is the ideal for low-temperature operations."

Lubrication at High Temperatures

The study of lubrication at elevated temperatures presents other difficulties, for, as is well known, viscosities fall off to a great extent at temperatures above the boiling point of water. From what has been previously described in this article on the subject of "fatty-oil" lubricants, or fatty acids, one might be tempted in cases of lubrication at elevated temperatures to suggest one of these. In other words, should 'boundary' conditions of lubrication arise, and since the latter-named materials reduce the coefficient of friction at normal temperatures, it would appear natural that there would be less danger in their use at elevated temperatures.

However, T. E. Stanton, of the National Physical Laboratory, has recently published results showing that, while one might expect castor oil to give better results at high temperatures than mineral oils, actually seizure took place at 138 deg. C. (280 deg. F.) when castor oil was used, whereas it was possible to obtain a mineral oil with a seizing temperature as high as 224 deg. C. (436 deg. F.). A further confirmation and explanation of this fact was found in the work of E. G. Gilson of the General Electric Company, who found that the fatty oils go through a change called "polymerization"—that is to say, form more complex bodies—which makes the material more viscous and causes excessive rise in friction. It was further learned that of the three oils, sperm, castor and lard, the first, which contains a large percentage of unsaponifiable matter, stood up the longest. Gilson found further in his friction studies that with the mineral oils a quantity of sludge formed similar to that formed on oxidation of the mineral oil. The experiments were conducted in both air and hydrogen gas. It was found that the friction was higher in an atmosphere of hydrogen than when the hydrogen was replaced by the air; further, that the friction was higher in vacuum than when air surrounded the bearing.

The experiments proved that the presence of oxygen (air) is essential for a mineral lubricant to give the least friction; also that the incipient oxidation, that is, the act of sludge formation, was the cause of this low friction. This is not necessarily the same as saying that all mineral oils give equal performance because of their tendency to oxidize. It is quite possible that oils might oxidize to such an extent that an excessive amount of

sludge-like material would be formed and as much harm done as by the polymerized product from the fatty oils. C. I. Kelly is responsible for the statement that he has not tested any lubricating oil having high content of sulphur compound which did not give far more oxidized material than a similar oil with less sulphur compound in it.

The conclusion to be drawn is that the chemical composition, as well as the oxidation tendencies, of lubricants derived from petroleum should be carefully studied when considering lubricants which are to be used at high temperatures.

Studies of Surface Tension

Other investigators, notably Dallwitz Wegener, have studied the problem of lubrication from the standpoint of the surface tension which exists at the border between the oil and the metal. It is not possible to determine this relation directly by measuring the surface tension between the oil and metal, but it may be determined indirectly by measuring the surface-tension phenomena between oil and water. The results of this group of investigators lead to the same conclusion that, with respect to water, the tension of vegetable and animal oils is much lower than that of mineral oils. The former possess to a high degree that property known as "oiliness" and it would appear that high oiliness is accompanied by low oil-to-water tension.

Furthermore, it was found that low interfacial (*i.e.*, between-the-surfaces) tension between fatty oils and water is due to the low content of free fatty acids in the former. In other words, by removing the fatty acids from the fatty oils an increase in tension was noticed; and, *vice versa*, when free fatty acids were added, the tension was lowered and the oiliness improved.

Of course, it is well known that all commercial, vegetable and animal oils contain small quantities of free fatty acids. Also that, in case attempts are made to eliminate these fatty acids, the oils immediately go through a process known as hydrolysis, which again produces these acids in a quantity sufficient to reduce the surface tension. Lewis showed by a study of the tension existing between oil and mercury that the tension decreases with increase in content of free fatty acids.

The researches of Langmuir on the spreading of fatty acids and fats over water led him to propose the basis of a chemical theory of capillarity. It depends upon the surface energy of those atoms of the molecules which are in the surface layer. The atoms on the surface layer are those which are the most active and, therefore, possess the most residual affinity or activity.

On the one hand, there is "fluid-film" type of lubrication in which the friction depends mainly on the viscosity of the lubricant under the working conditions and is, therefore, mainly a question concerned with the resistance to be overcome in the shear of layers of the liquids over one another. In this type of lubrication the chemical character of the oil does not play any considerable part. The matter is chiefly of physical concern. For "boundary," or "solid-film," lubrication, however, it becomes necessary to take into consideration the question of oiliness of the lubricant. From what has already been said, it is clear that in this type of lubrication the work of Langmuir, Trillat, and others leads to the conclusion that certain groups in the liquid lubricants possessing the most chemical affinity are directly adsorbed by the metallic surfaces with which they come in contact.

American Road Builders' Association To Meet at Atlantic City

The twenty-seventh annual convention and road show of the American Road Builders' Association will be held January 11 to 18, 1930, at Atlantic City, New Jersey. A transportation committee has been appointed, with Harry A. Karr as chairman, to assist all delegates and exhibitors, in both passenger and freight problems.

County-highway financing is being given much study by the executive committee of the highway officials' division this year with a view to the development of standard practical methods for the entire country. A questionnaire covering the sources of financing brought a variety of answers, among them the taxation of oil property, alimony, and wheels.

Extension of definite road programs into each of the 3,078 counties of the United States is sought by the county officials' group. It is pointed out that scarcely one-tenth of that number have a real program of either low-cost or high-type paving. The states were without road programs until state road commissions were brought into being by the federal-aid road law and rapidly formulated construction plans. It is thought that legislation might bring about a similar result in counties.

Aerial maps of county areas for highway planning are advocated by Stanley Abel of Taft, California, who maintains that air maps not only save time and money on location of county roads, but are of great aid also in studying traffic and transportation, in gathering data for reappraisal for taxation, for control of subdivisions, direction trend of improvements, and forest-fire prevention.

Coast Rock Awarded Large Contract

The Coast Rock and Gravel Company is to furnish the material for the new road being constructed from Ben Ali to Sylvan, Calif. The rock is to be hauled from the Fair Oaks plant to huge bunkers that have been erected at the Murford Service Station and thence distributed on the job.

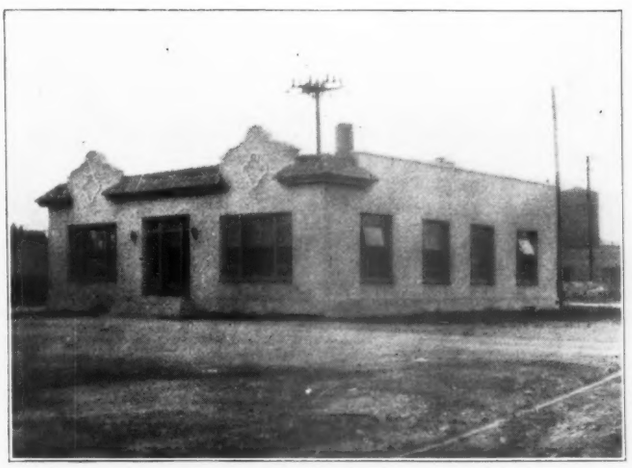
Ready Mixed Concrete Company of Kansas City Continually Expanding to Meet Demand

How an Aggregate Producer Found a Ready Outlet For Past and Present Production

By W. J. BRIMACOMBE

IN 1926 the late W. A. Ross, when president of the Ross Construction Company of Kansas City, Missouri, foresaw the possibilities for a ready-mixed concrete, scientifically prepared at a central mixing plant and delivered to contractors on the job. Accordingly a company was formed known as the Ready (Red D) Mixed Concrete Company, and the first unit of the present plants was constructed and put into operation early in 1927.

The product met with such universal demand that increased capacity became necessary and two additional units were built, one being located alongside the first unit, and the other at 86th St., and Lydia Ave., ten miles out of the south side of the city. The main plants are located on property adjoining the tracks of the Kansas City Terminal Railroad at 25th and Summit Sts., and are advantageously situated for deliveries to points within the main business and industrial sections of Greater Kansas City. No. 1 unit is of timber construction, while Nos. 2 and 3 are of concrete and steel.



General office at 908 W. 25th St.

The tracks of the Kansas City Terminal Railroad are elevated at this location, which permitted the construction of switch tracks for 24 cars on trestle work, with storage bins for stone and sand under the tracks. Materials are received in hopper-bottom cars. The storage bins have a capacity of 3,000 tons of crushed stone and 1,500 tons of

Front view unit five and two at 25th and Summit

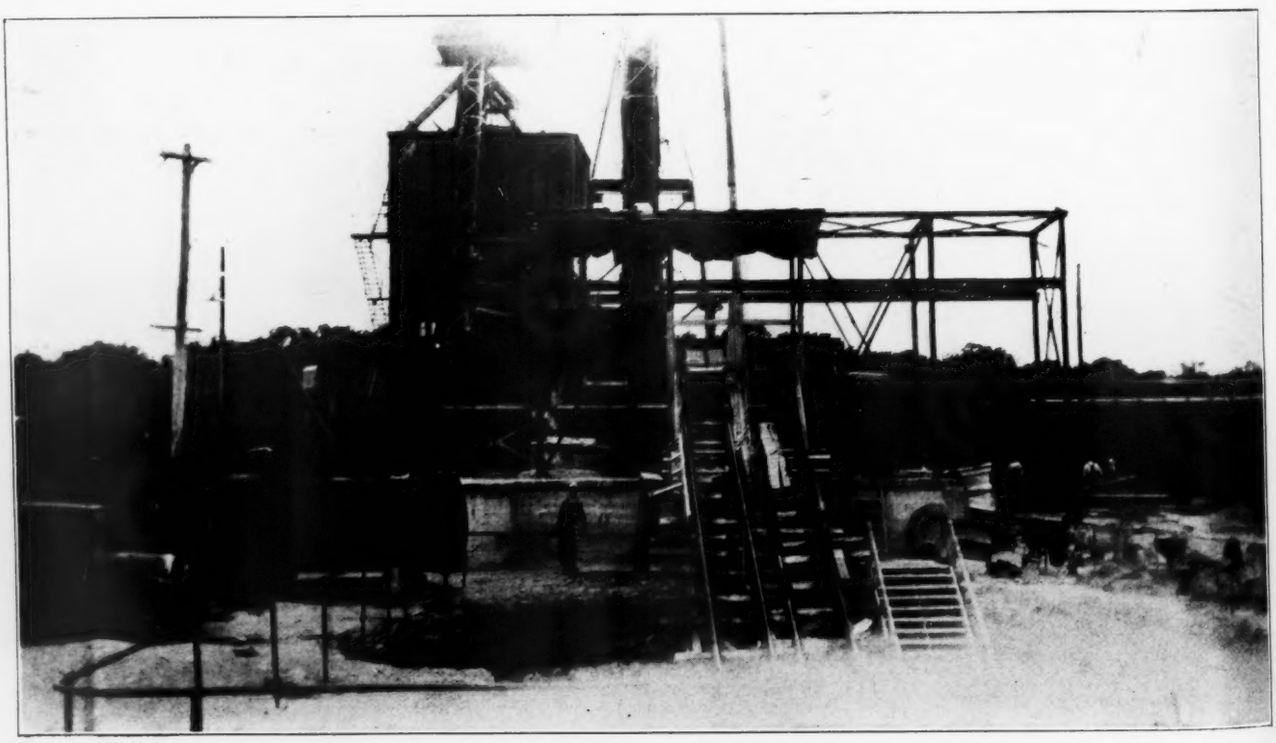
Unit No. 3 at 86th and Lydia

sand. Cement is delivered to the plant by the Kansas City Public Service Company, the cars being placed on the cement track located on the south side of the buildings from where it is trucked into the cement warehouse at either end of the

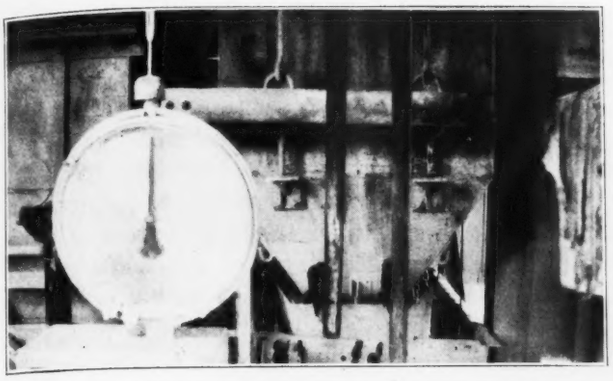
Elevator, truck and mixer. Unit No. 2

mixing plants. Carrying a large stock of cement is not necessary, as daily deliveries are made from warehouses maintained in the city by cement companies. The company is contemplating the erection of silos so that cement can be handled in bulk and pumped to storage, thus eliminating all the labor used in trucking from cars, charging batchers, and cleaning and handling empty sacks.

The crushed stone and sand storage bins are located over a concrete tunnel 7 ft. by 7 ft. by 400 ft. Clamshell bin gates in the roof of the tunnel, six feet apart, provide for feeding to the conveyors. Two conveyor belts, one of 350-ft. and one of 50-ft. centers, furnished by the Chain Belt Company, driven by 15- and 10-h.p. General Electric motors, convey stone and sand to two 24-in. inclined conveyors of 60-ft. centers, driven by 5-h.p. General Electric motors and located at right angles to the tunnel. Each mixing plant is served by one conveyor. The shorter conveyor in the tunnel



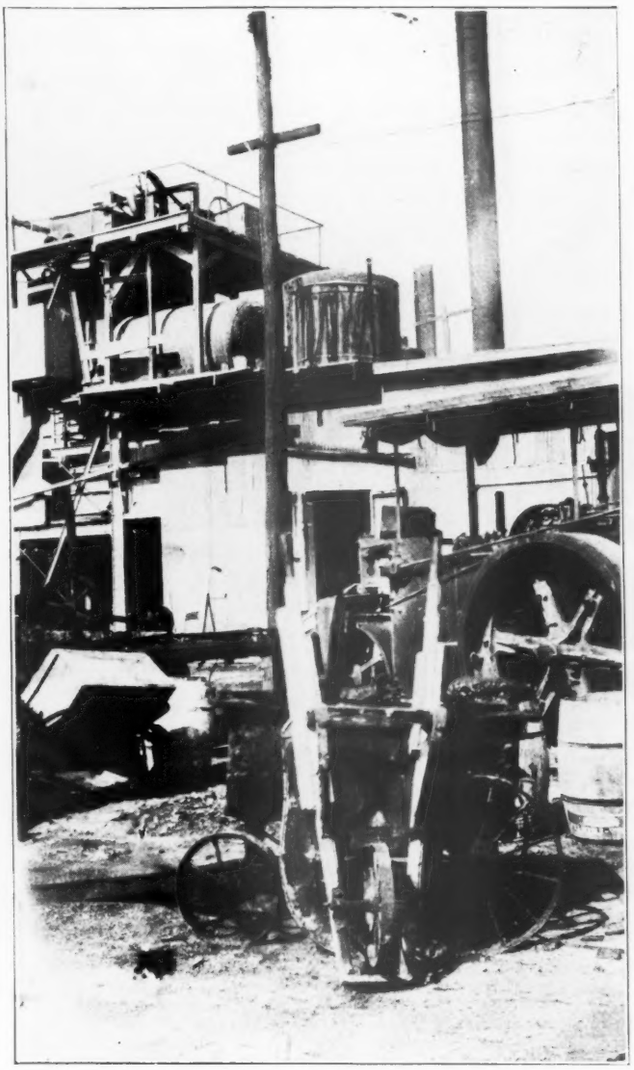
Front view of crusher house and incline with mixing plant in background



Batching scales and batcher. Unit No. 2

was installed when the second unit was added to the plant, the long conveyor discharging on to this belt, as well as on to the cross conveyor serving the first plant unit. Both cross conveyors discharge into hoppers under which is an apron feeder 2 ft. by 5 ft. which delivers material to bucket elevators. The elevators are on 65-ft. centers and are driven by 25-h.p. General Electric motors, one being an Allis-Chalmers belt type, and the newer one a Link-Belt roller type, wood frame, both having 18-in. buckets. The material discharges into storage bins at the top of plants, each plant having storage for 200 tons of stone and 200 tons of sand.

Batchers supplied by the Kansas City Steel Products Company are located below the storage bins and are connected to Fairbanks-Morse scales, dials being directly in front of the operator handling the batchers. Below the batchers is a steel hopper of 5-yd. capacity, into which the contents of the batchers are dumped and into which is discharged the required amount of cement. A standard batch consists of 60 cu. ft. Water is furnished from a steel tank of 100-gal. capacity located at the left of the batchers and controlled by a float valve. On the side of the tank facing the operator is a gauge glass extending from top to bottom, and on the tank on each side of the glass is indicated the number of gallons at any level shown on the glass. A quick-opening lever-handle Crane valve in the pipe line to the mixer allows the operator to add

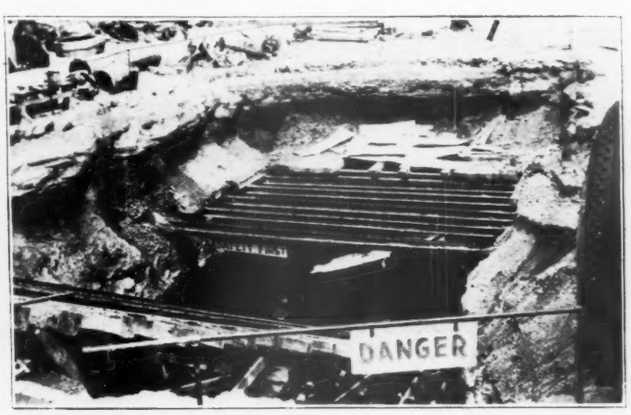


The asphalt plant

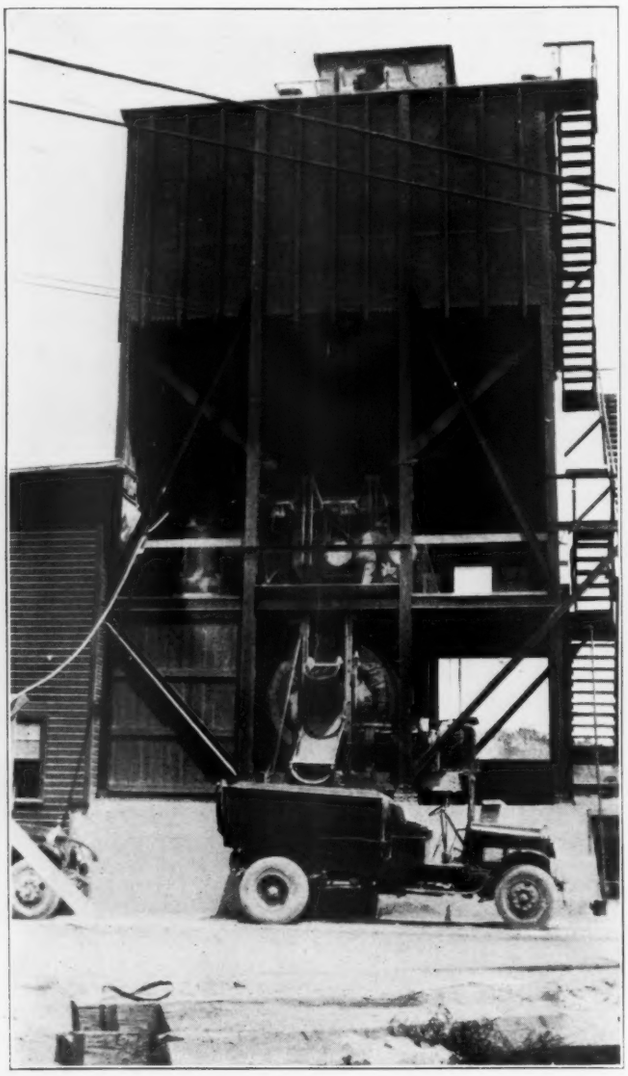
quickly the required quantity of water to each batch, this varying somewhat according to the consistency specified by the customer, and the moisture content of the aggregates before going to the mixer.

Below the batch hopper is located the 2-yd. Ransome mixer which discharges directly into trucks. The mixers are driven by 40-h.p. General Electric

Crushing plant at 86th and Lydia after fire



Entrance to mine at 86th and Lydia showing incline



Front view of unit No. 3, showing batchers, mixer and truck

slip-ring motors, 720 r.p.m., direct-connected. Cement is conveyed to the batch hopper by a Link-Belt enclosed bucket chain elevator of 25-ft. centers, speed 80 r.p.m. and driven by a 5-h.p. General Electric motor. The required number of sacks of cement are emptied into hopper fitted with a sliding gate, and discharged into the elevator upon a signal from the operator in charge of the mixer. Cement handlers are stationed below and to the right of the mixer operator and can converse with each other if necessary. All empty sacks are run through a Link-Belt sack cleaner, the recovered cement being elevated to an overhead bin and re-sacked.

The south-side plant erected in 1928 is operated in connection with a No. 7½ crushing plant owned by the company and located adjacent to the mixing plant.

Storage bins have a capacity of 200 yd. of stone and 200 yd. of sand. An 18-in. Link-Belt, all-steel roller-type, continuous-bucket elevator of 80-ft. centers, delivers stone and sand to bins. Material is fed to the elevator from a track hopper of 25-yd. capacity, under which is an apron feeder. Stone and sand received in drop-bottom cars is unloaded directly into hopper and stone from crusher bins is discharged into hopper by conveyor belt. The elevator has a speed of 80 f.p.m. and is driven by a 25-h.p. General Electric motor, chain drive.

The plant is of concrete and steel construction and shows considerable improvement over units 1 and 2, no expense having been spared in making this plant modern and efficient in every respect. The stone used at this plant is produced there, thus eliminating freight charges. Any surplus stone is shipped to the Summit St. plants.

The company owns and operates 32 trucks, 27 of which were supplied by the White Company, all of 2-yd. capacity. A fully equipped garage is maintained, where all repairs are made. Deliveries from each plant will be made over a distance of five miles or less, each truck containing 60 cu. ft. The capacity of each plant unit is approximately 65 cu. yd. of concrete per hour, and night deliveries are made when required. The largest one-day output from the two Summit. St. plants in 1928 con-made when required. The largest one-day output from the two Summit Street plants in 1928 consisted of 60 carloads of stone and sand in addition to concrete. The plants were operating two shifts of 10 hours each with an operating force of eight men for each of the three units, including four cement handlers. Provision has been made at the Summit Street Unit No. 2 to operate during winter months. An 80-h.p. firebox boiler, coal-fired, furnishes steam for heating both water and aggregates. Water is heated to a temperature of 180 degrees and live steam is turned into the stone and sand bins day and night. The mixer is heated by means of a kerosene flame forced into the discharge end under pressure. The mixed product leaves the plant at a temperature of around 65 degrees and truck bodies have canvas covering to protect the mix during delivery.

In 1928 the Ready Mixed Concrete Company took over the quarry and crushing plant then

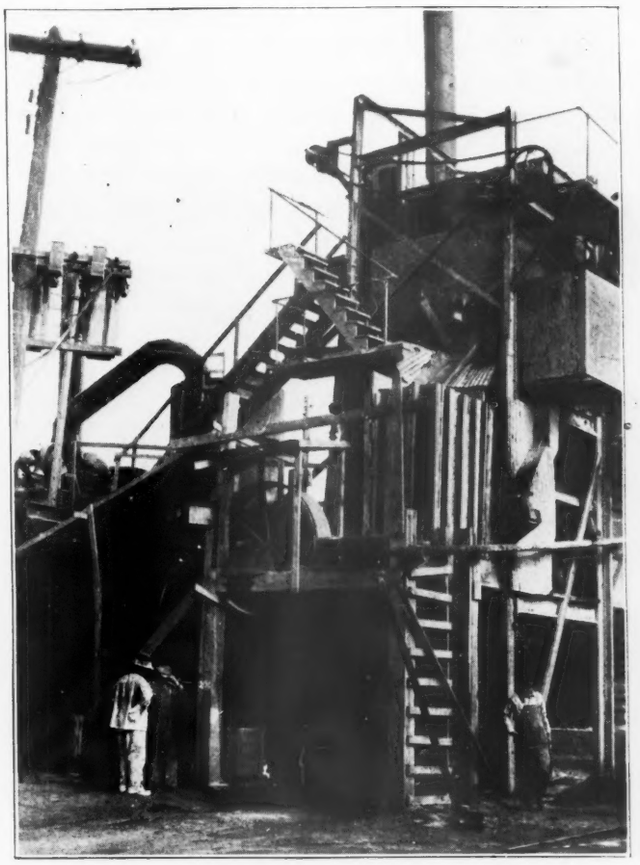
Trestle and storage bins at 25th and Summit

being operated by the Kansas City Public Service Company, located on their line at 86th and Lydia Streets. Considerable improvement to the property was made and the output brought up to 750 tons per day. Sunday, May 19, of this year, the greater part of this plant was destroyed by fire, supposed to have originated in the drying section of the pulverizing plant. The crusher building being of concrete and steel construction and which also housed motor control equipment and air compressor, suffered but little damage and this equipment is in shape for service. The screen house, bins, and pulverizing plant were a complete loss. Reconstruction is well under way and a more modern and efficient plant will be built.

The primary crusher is a Gates 7½, style "D," driven by a 100-h.p., 500-volt Westinghouse motor with a Texrope drive. The reduction crusher is a Kennedy 37, driven by a Westinghouse 30-h.p., 500-volt d.c. motor. Both crushers discharge into an 18-in. Link-Belt all-steel continuous bucket elevator of 80-ft. centers and driven by a 25-h.p. 440-volt General Electric motor, chain drive. The air compressor is an Ingersoll-Rand, 14-in. by 12-in. class E.R. 1, and driven by a 100-h.p. 440-volt General Electric slipring motor.

Vibrating screens will be used exclusively in the new plant and a Raymond impact pulverizer with an air separator will again be installed for production of asphalt filler and agricultural limestone. The screens are a Gyrex double-deck 48 in. by 102 in., a 42 in. by. 72 in. Gyrex doubledeck and a 42-in. by 60-in. Vibrex single-deck screen.

Quarrying of the stone is a mining operation, the floor of the mine being 35 ft. below plant level. Ledge quarried is a limestone known as the Bethany Falls formation. The deposit is 18 ft. thick, 14 ft. being quarried and 4 ft. left as a roof. Above the limestone is 10 ft. of black shale and over this in the surrounding hill is 40 ft. of inferior rock which will not pass specifications. Because of excessive overburden, the only feasible method of quarrying the Bethany Falls ledge is by mining. The stone is loaded by hand into two-ton end-dump steel cars. Forty men are employed as loaders and work on a tonnage basis. Drilling is done with Denver drills. The mine rooms are approximately 24 ft. in width and the supporting pillars are 20 ft. square. The roof is kept well trimmed and there is practically no trouble from falling stone. Quarry cars are pulled to the foot of the incline and hauled to the crusher by friction hoist using a double cable. The ascending car passes the descending car midway on the incline.

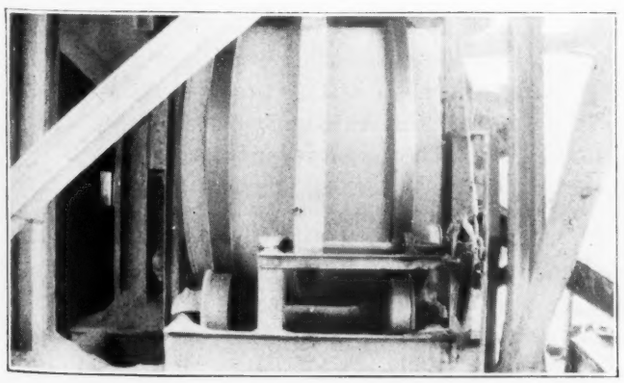


Asphalt plant, Midwest Paving Company

Another quarry location has been secured on the east side of the city and a new plant is now under construction, the capacity of which will eventually be 1,500 tons per day. This plant will be served by the Kansas City Southern Railroad.

The Asphalt Plant

Another industry which is a part of the W. A. Ross organization is the Midwest Paving Company. This company does a general paving business and in addition operates an asphalt plant at 30th and Southwest Boulevard. The capacity of this plant is 350 tons of asphalt per day and the product consists of sheet asphalt and asphaltic concrete. Deliveries are made by hired trucks. Stone and sand are received in cars and unloaded into bins and ground storage by a Link-Belt 50-ton crane using a 1-yd. clamshell bucket. From yard bins, the aggregate is carried to 60-in. by 30-ft. dryers, furnished by the Joplin Supply Company, by chain bucket elevators. Dryers are oil-fired



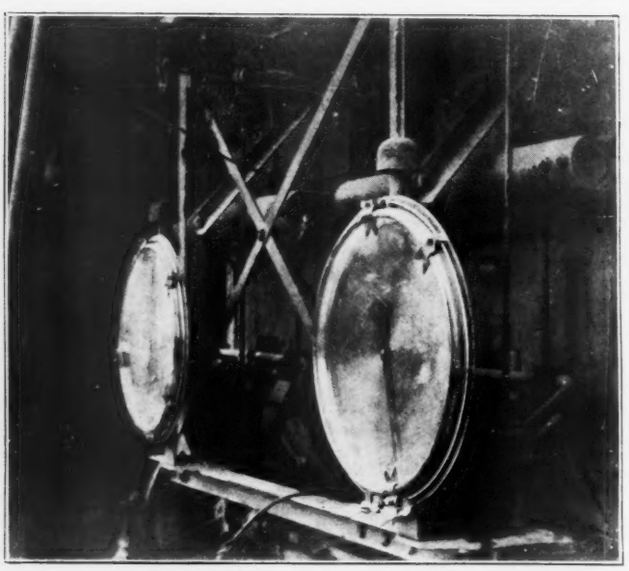
Side view of the mixer, unit No. 2

and materials are heated to 350 degrees. The dryers discharge into steel enclosed Link-Belt bucket elevators of 50-ft. centers, and the material is carried to revolving screens completely enclosed with steel plates. The screens discharge into bins below. Under these bins are located the Fairbanks-Morse batchers, and below this the Darby mixer or pug mill which has a capacity of 3,000 pounds. Asphalt filler is hoisted from warehouse on the ground floor by means of a pan fitted with rollers and running on an inclined track. This plan is controlled by a mixer operator. Heated asphalt is added in correct proportion and mixer is operated 1½ minutes for each charge. Stone, sand, filler, and asphalt are all weighed by Fairbanks-Morse dial scales before going into the mixer. Trucks drive directly under mixer from which material is discharged by means of sliding gates in the bottom of the shell. Asphalt is heated by steam coils and the steam is supplied by a 175-h.p. Scotch Marine boiler, oil-fired. Asphalt pumps are also operated by steam.

Both petroleum and lake asphalt are stocked, tank storage being provided for six carloads. Four hundred tons of stone and 1,000 tons of sand can be stored on the ground. Asphalt filler is supplied by the company quarry located at 86th Street and is equipped with 200-lb. sacks.

Heaters and mixer are driven by a 75-h.p., 440-volt General Electric slipring motor, elevators and screens by a 15-h.p. motor, and the exhaust fan by a 10-h.p. motor.

Officials of the Ready Mixed Concrete Company are as follows: Wm. M. Ross, president; T. J. Pendergast, vice-president; R. P. Lyon, general manager; E. L. Schneider, secretary and treasurer; W. J. Murphy, general superintendent; I. LaMasney is superintendent, in charge of asphalt plant. A. V. Eulich is superintendent, F. M. Colburn, assistant superintendent, and H. M. Kleifeld, superintendent of construction at the 86th Street plants. General offices are at 908 West 25th Street, Kansas City, Mo.



Close-up of batchers, unit No. 2

Cranes and storage yard, asphalt plant

This company is a progressive organization and plants and equipment thoroughly modern. Crushing plants are being constructed and quarries developed to operate in conjunction with mixing plants. It is thus able to produce the best quality of rock obtainable at locations having favorable shipping facilities and thereby supply the building and paving requirements of Greater Kansas City with a quality product at a moderate cost and with guaranteed deliveries.

The central mixing plant has undoubtedly come to stay. In cities where it has become established, contractors would not care to return to the old method of mixing on each individual job with its added cost, increased working force, and the inconvenience connected with handling cement, stone, and sand which usually must be stored on the street. The Kansas City Public Service Company formerly mixed concrete with its own equipment and crews but discontinued this practice entirely. Concrete is now delivered wherever needed, either day or night, and has resulted in eliminating interruptions to car schedules as well as vehicle traffic caused by unloading and storing stone and cement alongside the tracks, and the operation of large mixers such as they used. Concrete carefully proportioned and delivered from central mixing plants is destined to become the universal method of handling this end of construction work in cities of 50,000 or more population.

U. S. Gypsum Transports Rock to Plant

The first cargo of raw materials for the Calumet region's newest industry arrived July 22 in the Indiana Harbor ship canal when the S. S. Boland docked from Alabaster, Mich., carrying gypsum stone for the United States Gypsum Company.

New Developments in the Burning of Argillaceous Material for Use in Light-Weight Aggregate

The Product Is Resistant to Stresses, Has a Vesicular Character, and Can Be Quickly Made

By K. K. WYATT*

THE BURNING of argillaceous material for a great variety of purposes is one of the oldest of industries. The normal method of making brick, pottery, clay ballast, and the like results in a product that is in general lighter in weight than the ordinary aggregates used for concrete purposes. The burning of clay for use as a concrete aggregate and as a material that is not affected by fire has also been in use for probably twenty-five years. The use of crushed brick, as a concrete aggregate, has produced concrete weighing from 125 to 140 lb. per cu. ft. against a normal weight of 150 to 155 lb. per cu. ft. for concrete made from gravel or ordinary sand and crushed rock.

However, all these aggregates made by the burning of argillaceous material, clay or shale, have been produced by a low-temperature burning that gives a porous material, but one which is not vesicular or cellular in type. Such material is resistant to the action of water and fire, but is not highly resistant to stresses and does not give enough reduction in weight to be of particular interest. On the other hand, burning has been effected at high temperatures for a considerable period of time, resulting in the production of a heavy, dense material or a clinker that very obviously takes the place of the concrete aggregates, but is not as light as material made by the normal low-temperature burning processes. The new developments in burning argillaceous material have resulted in a product that is highly resistant to stresses, is extremely light in weight, has a vesicular or cellular character, has a minimum of harshness, and can be made by rapid burning of selected material at selected temperatures.

Formerly it was deemed necessary in burning argillaceous material such as clay or shale to hold the material under fire for an extremely long period of time, usually 10 hr. or more. At the present time, to make a high-class material, it is recognized that the burning should be effected in a very short time, not ordinarily exceeding 30 minutes. Under the old method of burning it was important to carry the burning through a long heating or oxidizing period to remove all gases produced from the combustion of the organic matter contained in the raw material. In using the new method of burning to produce a light-weight aggregate it is deemed imperative to prevent the escape of the gas from the burning of the organic matter as much as possible by heating the material to a temperature of incipient fusion or searing just enough to form seals to the escape of the gas. This gas then causes expansion of the argillaceous material.

The temperature of burning should be ordinarily about 2,000 deg. F. This, of course, depends to a large extent upon the raw material, it being desirable to heat it to a temperature at which some constituents will just begin to fuse. If fusion is carried to too great a degree, such as by too high a temperature or too long a period of time, a clinker will result.

Shale Rock Is the Ideal Material

In the manufacture of light-weight aggregate it is important to select the ideal material. First it is important to get a material that will not require much mechanical or chemical preparation and one that contains the right amount of organic matter to produce the right amount of gas. It is desirable to avoid the necessity of grinding the material into a powder, incorporating organic matter and then producing a paste. It is highly desirable to have the raw material with enough strength to maintain a particle size. For all these reasons the ideal raw substance is naturally decomposed shale rock. A shale rock has sufficient strength to maintain particle size during treatment and it contains a small amount of organic matter that furnishes the gas. It should have undergone enough natural decomposition so that it can be readily quarried and reduced to the desired sizes. With the above requisites for raw material it is a comparatively simple matter under the present knowledge of the burning of such material to make an aggregate from which a concrete of high strength and weighing from 70 to 105 lb. per cu. ft. may be readily produced.

The materials competitive with burnt-shale aggregate are such substances as coal cinders, pumice stone, and slag. All are used in certain localities advantageously. Coal cinders are used extensively in the making of cinder blocks, which have a very wide sale and are highly advantageous in building construction. Pumice-stone blocks likewise have been made in certain localities where the conditions would sustain a high price for the material. Slag is also widely used, but special methods must

*Chief engineer, Aggrelite Division, Silica Products Company, Kansas City, Missouri.

be followed to produce a uniformly satisfactory light-weight material.

Among the particular objections to coal cinders and slag is the fact that they both carry a large amount of sulphur in injurious form. Cinder concrete is extensively used, particularly in large cities where there is no chance that the concrete will subsequently be subjected to the action of water. There is no question but that, in such localities, burnt-shale aggregate would completely displace cinders if the burnt-shale aggregate were available. The price would be of little importance. The strength of concrete made from coal cinders and pumice is inferior to that made from burnt-shale aggregate.

The principal use of burnt-shale aggregate is for concrete where light weight is the important requisite. It is probably the ideal aggregate for all types of precast concrete units, particularly those units that must be transported by motor truck or railway. Such units include building block; water and sewer tile; roofing tile; telephone, telegraph and light standards; precast tanks such as laundry tanks; railroad ties; precast joists; roof slabs; burial vaults; and many other items that are apparent from the character of the material.

Aggregate Made From Burnt Shale

The aggregate ready to use ordinarily weighs about 1,300 lb. per cu. yd., although this weight varies with the character of the material and the method of burning. The concrete for most structural purposes has a crushing strength approximately the same as that of ordinary rock-and-sand concrete. This would vary from 1,000 to 4,000 lb. per sq. in., depending upon the mix, the water-cement ratio, and the admixture materials used. In many instances it is desirable to add certain substances such as aquagel or zonolite to improve the plasticity or to increase the lightness of the product.

In mass concrete, as well as in blocks, the use of burnt-shale aggregate effects an enormous saving in both structural-steel buildings and reinforced-concrete buildings, due to the elimination of nearly one-third of the dead load. A saving of as much as one-fourth of the cost of the steel and cement, as well as a saving of space by the use of beams and columns, is effected. In fireproofing steel it is possible to get a greater fire resistance as well as a greater insulation value, so that a thinner covering of concrete is required by the use of a burnt-shale aggregate. On existing buildings it is often possible to put on additional stories when this could not, because of the existing foundation design or superstructure, be done by using ordinary rock-and-sand concrete.

An important feature of light-weight-aggregate concrete is the fact that nails can be driven into it without using nailing plugs and strips. In the form of building blocks, also, the material can be cut or channeled with an ordinary saw or mason's hammer.

Another important property is the soundproof value of concrete made by the use of burnt shale. Due to the cells or pores, sound does not readily pass through a partition wall made of this type of material. The aggregate itself is not porous in the sense that it has any capillary action with water, and for that reason, particularly by the use of plasticizing agents, the burnt-shale aggregate is highly impervious to water. There is nothing in burnt-shale aggregate that will cause rusting or corrosion of metal parts or cause deterioration of concrete of which it is a constituent.

The Saving in Weight

As a general thing, the weight of burnt-shale concrete units will average about one-eighth less than that of cinder blocks, three-eighths less than that of tile, one-third to one-half less than that of ordinary concrete units, and two-thirds less than that of brick. By the use of a plasticizing agent (such as aquagel or celite) the mortar used in laying up the burnt-shale units may be made of sand-size burnt shale, thus further reducing the weight of the construction.

On account of the heat-insulating value, burnt-shale concrete makes an ideal material for roofs, still settings, boiler settings, and the like. It is an inexpensive and waterproof material for covering steam lines and for general refrigerating purposes as well as for insulating hot-oil lines, fractionating towers, and for similar purposes around refineries or petroleum plants, where sudden changes in temperature cause interference with operation or injury to fittings. For insulation purposes, it is possible to use a large amount of water in the composition when great strength is not required.

An interesting feature of burnt-shale concrete is the fact that it is very much less susceptible to cracking or spalling than the usual type of concrete because of the considerable flexibility of the aggregate itself. This makes it possible to use this material in large monolithic structures, such as swimming pools, where it is necessary to prevent cracking, or in walls of any type in which cracks are likely to open and cause extensive leaks of water.

Another use for burnt shale is in the manufacture of asphaltic pavements. These, when built of ordinary sand and gravel, are often not stable, due to the rounded shape of the aggregates. Such pavements have a tendency to wave or become displaced in other ways. When burnt-shale aggregate is used, however, the particles are thoroughly interlocked and provide a contour to the pavement that is permanent and desirable.

Collecting Information at Little Expense Which Will Prove Useful in the Future

How the Most Valuable Material of Trade Periodicals Can Be Clipped and Filed for Future Use

By J. J. BERLINER

EVERY ISSUE of a trade journal contains material and data of a practical value to some business or other. New technical articles in the magazines written for the enlightenment of business men and their employees are being published every day. Yet few men can find the time to examine this mine of information and fewer still classify and file this information for future reference. Of course, it is obviously impossible for the average business man to read regularly even half a dozen periodicals a month, unless his reading is carried out systematically and references are made to the items which pertain to his work and are worth filing. The search through old copies of magazines for articles that may be of value in the solution of a problem is almost useless unless some guide is furnished.

In order to convert its files of old periodicals into a practical mine of information, one large concern has adopted a method of classifying and filing all data which might be of interest or value, and this plan has proved worth the trouble involved many times over. It may be readily adopted by any business.

Each of the numerous heads—engineers, chemists, buyers, sales manager, clerks, etc.—was asked to prepare a list of magazines which contained information in any way helpful to the work of his department. In some cases several department heads requested the same magazine. An alphabetically arranged list of publications was prepared. The names of the departments which desired the publication were also noted. When more than six men asked for the same magazine, it subscribed for two copies.

When a publication is received at the office, a red label (Form 1) is attached to its cover. On this label the clerk inserts the names of the persons to whom the periodical is to be handed and the dates when it is to be forwarded to the next man on the list. For instance, if Mr. Doe, Mr. Roe, and Mr. Smith all wish to see a copy of PIT AND QUARRY, their names are entered in order upon the label as shown in the specimen illustrated.

Passing the Magazines Along Quickly Improves Their Usefulness

Four days is allotted to each man on the list. This time limit prevents delays and insures prompt attention to every publication during its brief stay in each office. The time-table is so arranged that no man has more than two magazines at one time.

Only those articles, of course, are read which bear directly on the work of an individual or department. If the department head desires to index articles for reference, he simply indicates them to his stenographer, who fills in an "Index Request" (Form 2) and sends it to the indexing department, where the entries are transferred to a four-inch by six-inch index card (Form 3). These cards are classified according to all the various subjects of interest to the numerous departments—accounting, advertising, business efficiency, engineering (in its

Each of the following men desire to read this magazine. It is to the interest of all that each finish it in his allotted time. Send on promptly to the next man in turn.

NAME	FROM	TO

MR._____Please return to The Indexing Dept.

Form 1—A red label to be attached to cover of magazine.

INDEX REQUEST

Mr._____Wishes You to Index

Articles in the_____issue of_____

Subject _____Page_____

Form 2—Index request for use of indexing department.

Subject_____

Title of Article_____

_____

Author_____

Appeared in _____

Issue of_____ File No._____

Form 3—A 4- by 6-in. card where entries are transferred.

various divisions), chemistry, mill practice, purchasing, selling, shipping, traffic, etc.

How the Executive Draws on the File For a Variety of Information

These index cards are placed in the general card file. Each department head who has requested the indexing of the article receives a duplicate, which is placed in a reference file in his own office. Thus, when a knotty problem comes along some day, he has merely to refer to his own index to be able to make a request to the clerk in charge of the main file for the magazine he desires. If he fails to find the desired subject in his private index, he can still have recourse to the main index, where the same article may have been filed at the request of another department. Or he simply advises the indexing department to send him a complete list of all articles which deals with the specified subject. All the catalogues and announcements of publishers of technical books also come to this indexing department. Books are purchased on the approved request of department heads, and are indexed as well as in the main index.

A test of the scope of this service was recently made by one department when it asked for all information on hand dealing with purchasing. It received seven books and over sixty articles on the subject.

Of course, not every business need have a special department for taking care of the filing of trade periodical data. But there should be some method of collecting and filing the valuable material of the trade periodicals in that line of business. The system described above can well serve as a guide for every business. It may mean the savings of thousands of dollars in the future.

New York Crushed Stone Association Members Hold Summer Meeting

A summer meeting of the New York State Crushed Stone Association was held July 19, 1929, at Hillcrest Farm, Churchville, New York, the Genesee Stone Products Company being host.

The beautiful grounds of the Hill Crest Farm Estate made an ideal setting for a program of outdoor sports and exciting contests were run off in horse-shoe pitching, Scotch and African golf, baseball and bull riding.

The meeting was called to order at 2 p. m. by President Savage and minutes of the previous meeting were read by the secretary and approved.

A resolution was introduced directing the secretary to write to the highway department of New York State, calling attention to the great value of stone screenings for use as pavement shoulders.

George Schaeffer reported that, in the future, associate members of the New York State Chapter, Associated Contractors of America, would be represented on the directing committees.

It was reported that the use of two-course concrete roads made entirely from gravel was being advocated and it was the sense of the meeting that the value of crushed stone in this type of construction should be stressed as crushed stone is superior in regular concrete and bituminous roads.

A motion was made that the president be instructed to appoint a committee to look after the interests of the Crushed Stone Producers in New York state and President Savage appointed the committee as follows: Chairman J. L. Heimlich, Reed Callanan, W. L. Sporborg. N. S. Snyder of the Link-Belt Company, Buffalo, was elected an associate.

At the invitation of Mr. Callanan the place of the next meeting was decided on as either Albany or Amsterdam, the time to be the fourth Friday in August. A very hearty vote of thanks was then extended to Mr. Boice and the Genesee Stone Products Company for their hospitality.

Those present were Messrs. Reed Callanan, Callanan Road Improvement Company of Albany; Fred Foote of Wickwire Spencer Steel Company, Gasport; H. J. Russell, Jointa Lime & Stone Company, Glens Falls; H. H. Hodgkin, Gouverneur Limestone Company, Gouverneur; J. L. Heimlich, D. L. and Deans Moore of the Le Roy Crushed Stone Company of Le Roy; James Savage and A. L. Hooker of Buffalo Crushed Stone Company, Buffalo; John H. Odenbach, Charles Odenbach, Matthew Odenbach, Frank Waddell, Harvey Clark, Leonard Harris, Arthur Sickles and Richard Howland, of Dolomite Products Company, Rochester; Wm. McGrew of L. & N. Stone Company, Prospect; Arthur B. Caldwell, Delancey M. Boice, Neil Caldwell, C. Buckholtz, L. E. Whitlock, F. T. Bibb of Genesee Stone Products Company; A. S. Owens of Peerless Quarries, Incorporated, Utica; F. W. Schmidt of Morristown Stone Company, New Jersey; W. L. Sporborg, A. L. Acott, J. W. MacCone, F. C. Owens, G. E. Schaeffer, O. Deitschler, G. S. Murphy of General Crushed Stone Company. Associate members, W. Anderson, Hercules Powder Company; D. L. Cheney and C. M. Howser, Marion Steam Shovel Company; J. A. Lang and F. T. Ransom of E. I. Dupont de Nemours Company.

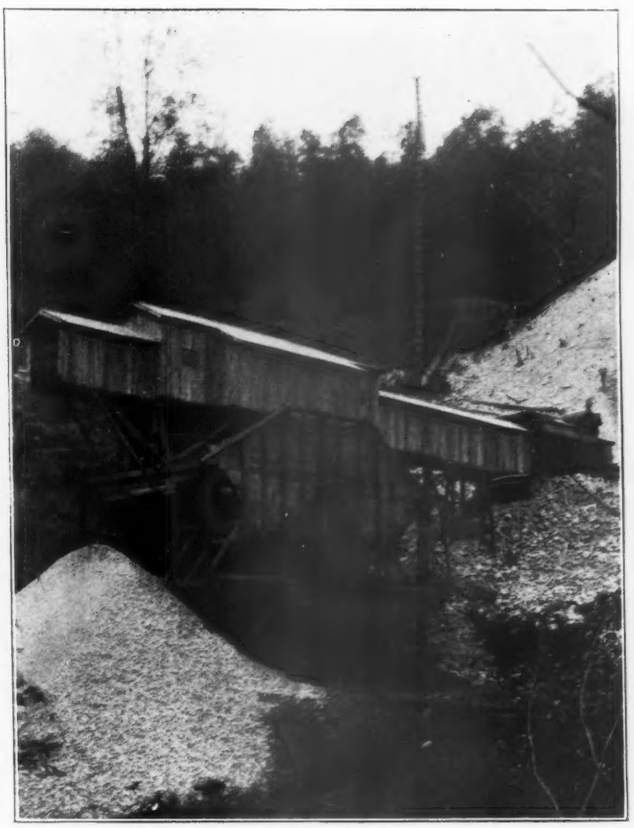
United States Feldspar Corporation Operates Modern Plant in Northern New York

BY FRANCIS A. WESTBROOK

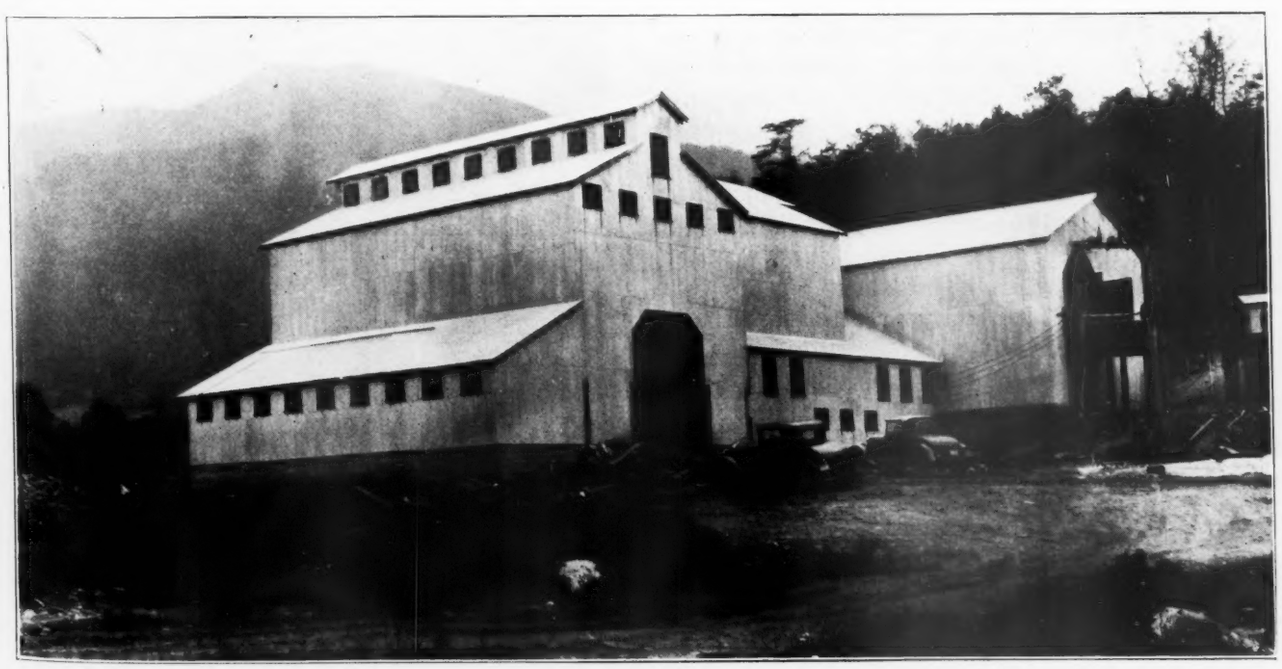
THE United States Feldspar Corporation recently published a booklet called "The Story of Feldspar" which gives in a brief and interesting way some of the salient facts about feldspar in general and this company's operations in particular. Because of the interesting historical and practical information contained in it, which almost anyone will be glad to know, it is a very effective bit of publicity. So the description of this company's operation at Cranberry Creek, Fulton Co., N. Y., cannot, perhaps, be introduced in any better way than by giving a few brief extracts from this booklet.

The first of these is a quotation from a U. S. Government Report by A. S. Watts in which he says that "The feldspars of the Fulton County district, N. Y., are famous for their fine color, and have been drawn on exclusively for use in raising the quality of the output from semi-exhausted quarries in other districts.

The United States Feldspar Corporation's deposits cover about 3,500 acres, owned and leased for long terms, in the Mayfield Hills of Fulton County, which are foothills of the Adirondacks. In the booklet referred to there is a quotation regarding these deposits from Prof. J. B. Shaw, in which he says, "It is much better than a large percentage of the spar now on the market. Unless there are new deposits of spar as yet undiscovered, the price of



Working the abandoned dump



Front view of the mill

Opening mine in new location for additional material

feldspar must go up and you might find in a few years that you have the only feldspar available which is suitable for porcelain and white ware."

In another part of the booklet a summary is given of the manufactured products in which feldspar plays an important part and shows in a striking manner how essential this product is in our everyday life. These products are: Pottery, porcelain, glass, porcelain enamel, stucco dash, chicken grit, concrete facing, electrical insulation, sand paper, emery wheels, paint, wood filler, terra cotta, abrasive soaps and powders, cements, polishes, sand blast material, scouring powder, tiling, sanitary ware, roofing grit, enameled brick, Faience work and so forth. Of course the fact that feldspar is the only known material which fuses, or melts, and acts as a cement, or binder, when mixed with clays and burned in a kiln, accounts for many of the above uses.

On the other hand, the company also turns out a product called "Fel-So," which is a scouring and cleansing powder for hard surfaces such as enamel, porcelain, glass, bath tubs, brass, nickel and so forth, where it is a question of making use of the abrasive qualities of feldspar rather than the cementing property under heat.

A third use for feldspar is illustrated in another product of the company called "Bio-Spar," which is pink feldspar associated with small quantities of quartz and mica. When crushed, this produces a very sharp granular material of a pleasing color which looks a good deal like granite and is used for non-skid floors, walks and facings for all sorts of brick, cement, stucco and similar kinds of poured, moulded or troweled structural work.

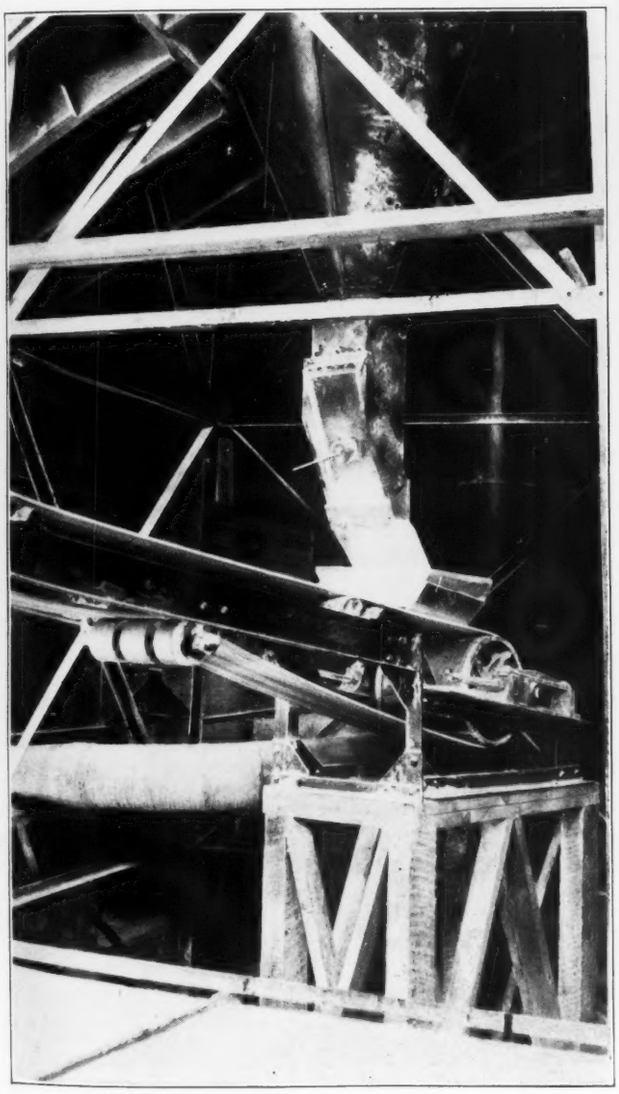
The quarry is located some 2¼ miles from the mill and at an elevation of about 640 feet above it. For the obvious reason of facility in loading freight cars, the mill is located near the railroad with its own siding instead of at the quarry. In the quarry the rock is drilled with Ingersoll-Rand jack hammers and shot with 40 per cent Dupont and Atlas dynamite. The stone is loaded into aerial tramway buckets set on small flat cars for convenience in moving about the quarry. An Ingersoll-Rand electrically driven compressor unit has been installed at the quarry for the operation of the drills.

A Bleichert system aerial tramway, manufactured by the American Steel and Wire Company and provided with steel towers, has been installed to transport the feldspar from the quarry to the mill. It is electrically driven and, due to the fact that the quarry is materially higher than the mill,

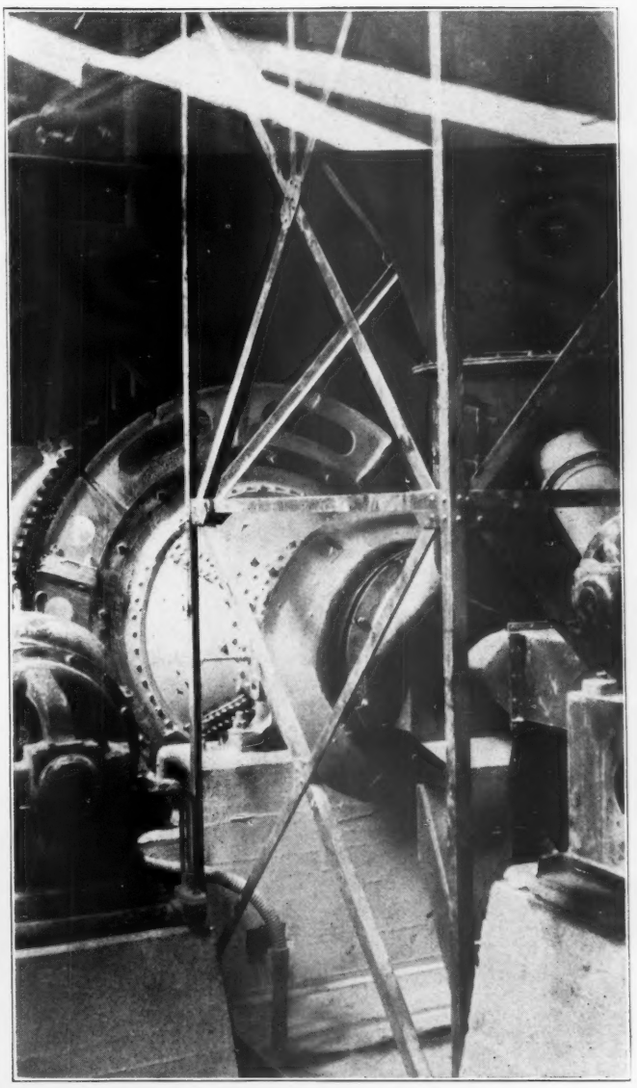
Tractor with trailer attached, unloading into storage bins

the descent of the loaded buckets helps to haul up the empty buckets so that the power consumption is low. The present capacity of the tramway is 15 to 20 tons per hour, with a maximum capacity of 50 tons per hour, each bucket holding about 900 pounds.

At the mill end of the tramway the stone is dumped into a bin or onto an outdoor storage pile close to the bin. When stock is to be taken from the storage it is placed in the bin by means of a stiff leg derrick and Hayward orange peel bucket operated by an American Hoist and Derrick Company electrically driven hoisting engine. This surplus storage, of course, insures a continuous supply for the mill in case the flow from the quarry should be temporarily held up by bad weather or repairs, or in case a sudden demand should for a short time increase the output of the mill beyond the capacity of either the quarry or the tramway. In other words, by the simple expedient of having a surplus storage pile, a considerable amount of flexibility is secured by means of which quarry expense and overhead can be kept at a minimum.



Air-swept attachment discharging on conveyor belt



Discharge end of mill

Quarry stone is fed from the bin by a Link-Belt steel apron feeder to a Traylor Bull Dog 18-in. by 30-in. jaw crusher which has a capacity of 60 tons per hour. The stone is broken down to about 2 inches in size.

It then passes by gravity through another apron feeder to a revolving washing screen of our own make and into a bin. An apron feeder discharges onto the picking belt which is a short Link-Belt belt conveyor where the unusable stone is removed. The picking belt discharges into a hopper which feeds, again through Link-Belt apron feeders, into two Blake crushers which crush the stone to ½-inch size.

From this secondary crusher the stone is taken by a Link-Belt elevator to a bin from which it is fed by gravity into a Ruggles-Coles rotary dryer. After drying, the material is elevated into bins by a Sturtevant elevator. Stone from different parts of the quarry is placed in separate bins and samples are taken at frequent intervals for analysis, especially as to quartz content. The material is

Battery of screens

then weighed out of the bins in the correct proportions to make a feldspar mixture of known and controlled chemical constituents for the blending of a product suitable for the customers' needs or for the specialties made by the company itself.

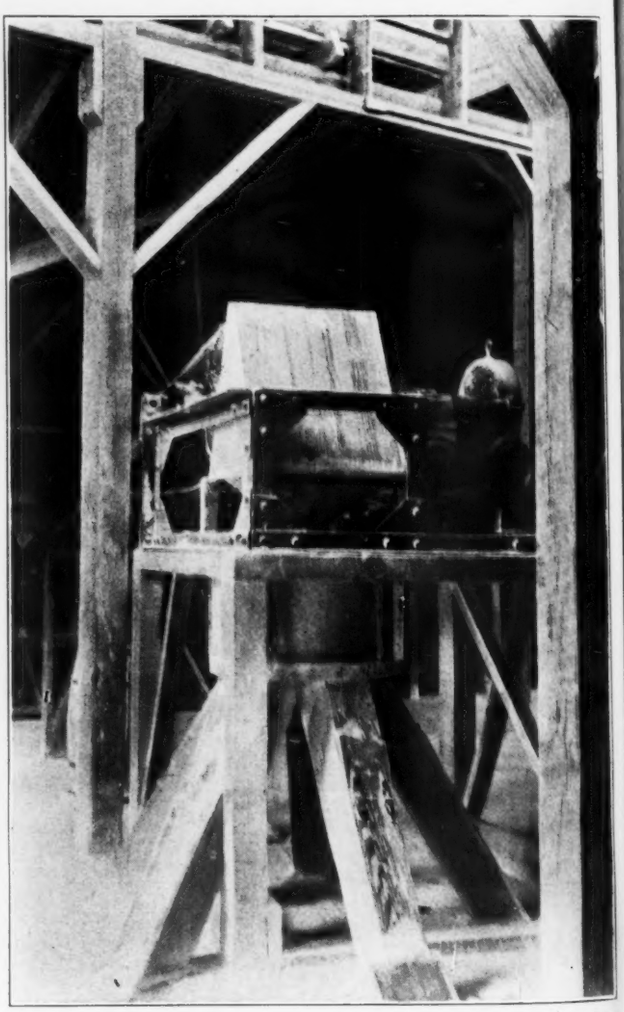
The mixture is then taken by a Sturtevant elevator to a bin which feeds an 8-foot by 48-inch Hardinge conical mill. The mill discharges onto Hummer screens, out of which the material comes in the form of Bio-Spar crystals, already mentioned, for use in decorative work. These descend by gravity into bins, or are carried on to the pulverizing processes if destined for ceramic purposes.

The material for ceramic purposes is passed through two large magnetic separators of the Rowand-Witheral type for the extraction of iron and iron bearing materials, which is particularly necessary if the crystals are to be used in the manufacture of electrical insulating products. From the two magnetic separators the material is carried by two Link-Belt belt conveyors to a Hardinge tube mill and from the latter to an Emerich air classifier made by Gayco.

The fines from the separators are deposited in bins from which they are loaded into freight cars in bulk by Link-Belt screw conveyors. The oversize from the air separator is returned to [illegible] mill by other Link-Belt screw conveyors. Very little material is shipped in bags.

This mill, which is new and is equipped with the best and most up-to-date machinery, has a capacity of 5 tons per hour and space has been provided for doubling this capacity. The wood framework of the building is covered with Robertson protected metal sheathing. All operations are electrified with General Electric equipment.

In closing, it should be stated that the United States Feldspar Corporation has lately consolidated with the Tennessee Mineral Products Corporation of Spruce Pine, N. C., and with the Oxford Mining & Milling Company of West Paris, Me. (see article in 1925 issue of Pit and Quarry for description of this plant) under the name of the United Feldspar Corporation, with offices at 10 East 40th St., New York City. The officers of this corporation are: President, Francis E. Haag; vice president and general manager, C. H. Peddrick, Jr.; secretary and treasurer, H. M. De Lanoie.



One of the distributors

National Gypsum Remodels Luckey Lime Plant To Meet Demand Created by Sales Effort

Six New Kilns Were Installed to Increase the Manufacture Of Gold Bond Products in the Luckey Field

SINCE taking over the lime plant of the Luckey Lime & Supply Company at Luckey, O., the National Gypsum Company has utilized its extensive selling force to market the products of this plant in a steadily mounting volume.

Although the plant did not become one of the units of the National Gypsum Company until last September, the greater sales volume already obtained has necessitated the installation of three additional kilns and further extensions are indicated.

The additional kiln capacity was put in early this spring. The plant, which is only seven years old, was planned and erected in a distinctly modern manner and is situated at one of the finest deposits of dolomite rock in the famous Northwestern Ohio strata.

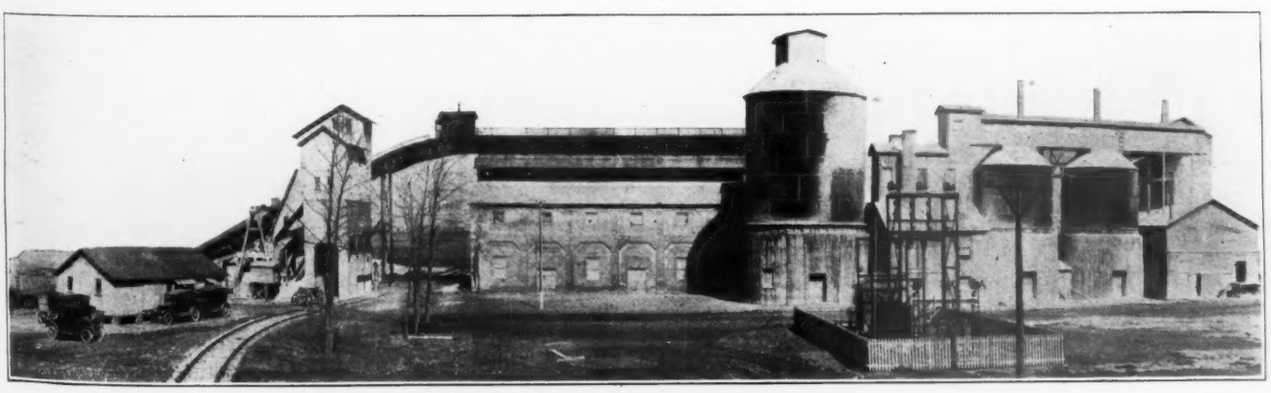
In becoming a unit of the National Gypsum Company's line, the lime produced at Luckey is now known as Gold Bond Lime, the Gold Bond name and trade-mark being used on all the major products produced by the National Gypsum Company. Gold Bond Exterior stucco and Gold Bond texture paint also are made at the Luckey plant.

The other Gold Bond products, wallboard, plaster, lath, sheathing, insulation board, tile board and dry fill insulation are made at the Gold Bond plants in National City, Mich., and Clarence Center, N. Y. The executive offices of the company are in Buffalo, N. Y.

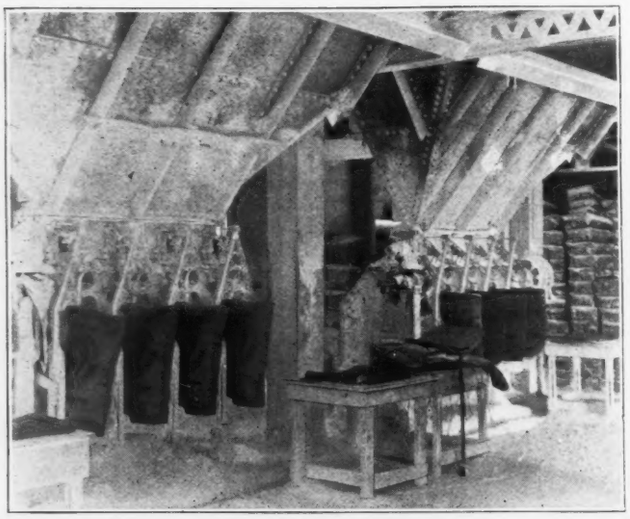
The Luckey mill is operated as a separate unit, although responsive to the direction of the General Production Manager, G. H. Tarbell, at Buffalo. W. E. Hessman, the superintendent of the Luckey plant, has been in the lime business for many years and has been in charge of the Luckey mill since its erection.

View of quarry and car

The Luckey mill operates under a rigid system of quality control which is under the direction of H. J. Tanner, the chief chemist at Luckey. Mr. Tanner has been engaged in laboratory control work in the gypsum and lime fields for many years.



View of Luckey lime plant



Lime bagger in action at plant

The Gold Bond properties at Luckey cover sixty acres. The deposits rank among the finest in the dolomite lime field. At the present time, the rock is being taken out on a fifty-foot face, although the stratum runs considerably deeper.

The inspection system is exceptionally rigid. Every shipment is held to predetermined standards for plasticity, consistency, wet bulk and working qualities. To make sure that the lime is correctly burned, it is subjected to CO_2 analysis. This is further checked by a pyrometer, which is used to read the temperatures in the kilns at frequent intervals.

There are six 11-foot and two 13-foot Arnold & Weigel kilns. As the burned lime comes from these kilns, it is put on an apron conveyor, where it is carefully sorted for any off-color, underburned or overburned lime. It then goes to the No. 5 Williams swing-hammer mill, where it is broken into small lumps of about 1 inch down. Then it is either placed in the silo for storage or taken directly to the hydrators.

Kilns recently installed

There are two Clyde hydrators in the mill. These hydrators are operated under close control to make sure that the proper amount of water is added to the burned lime, frequent tests being taken during the hydrating process. After hydration, the lime is taken to a Bonnot mill for grinding to the desired fineness. It is then taken to storage tanks or brought direct to the bins over the Bates packer, where it is sacked and loaded into cars.

The present capacity of the eight shaft kilns is an average of 95 tons of burned lime a day, or 110 tons of hydrated finish lime. In addition to the lime mill proper, a special plant has been installed for the making of Gold Bond exterior stucco, Gold Bond texture paint, and the line of

Hydrator in operation

small packaged limes for which considerable business has been developed.

The progress of the National Gypsum Company has been exceptionally rapid during the three years that it has been in active operation. The first plant was opened at Clarence Center, N. Y. and this was followed by another large plant at National City, Mich. The company is now the second largest producer of gypsum wallboard and the third largest operator in the gypsum industry.

The annual report of the French colonial firm, Chaux, Ciments et Materiaux de Construction au Maroc, shows a net profit of 3,926,536 francs ($785,307). The capital will be increased from 14,000,000 to 22,000,000 francs ($2,800,000 to $4,400,000), the 8,000,000 francs ($1,600,000).

Mining a Non-Metallic Mineral Is Made to Yield a Metal Product in New Western Plant

Magnesium Is Recovered from Dolomite by Methods That Are Ninety Per Cent Efficient

By J. C. ALLEN, JR.

DOLOMITE is the technical name for the variety of limestone that contains, in addition to the usual carbonate of calcium, a considerable proportion of carbonate of magnesium. In other words, it is a double carbonate of lime and magnesium. When only carbonate of magnesium is present the rock or mineral is known as magnesite.

Operations began in April of this year at a small but interesting plant about five miles northeast of the little city of Logan, Utah, in what is known as Green Canyon. The activities are based upon a splendid deposit of dolomite that occurs as practically a solid mountain. The Little Flower Mining Company was incorporated to excavate and treat this rock for its metallic magnesium content which, it is believed, will average between 12 and 18 per cent.

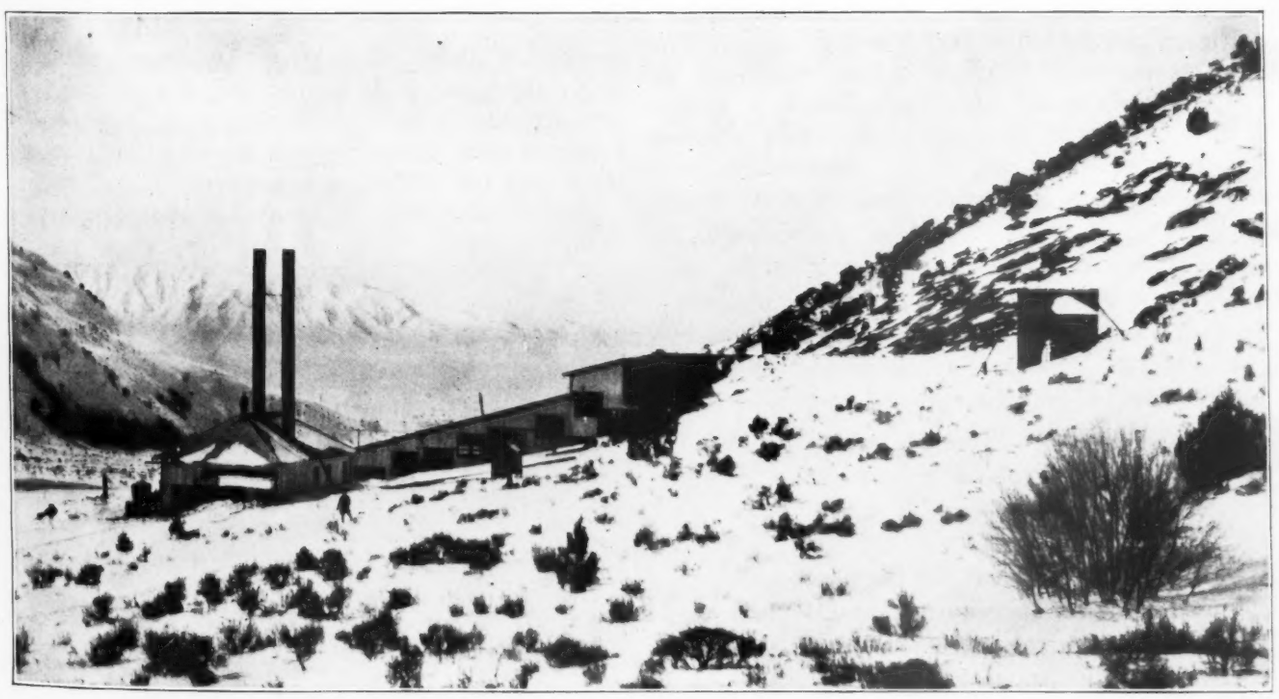
Work on the plant was started last fall and the pictures herewith indicate the adverse climatic conditions under which the construction was done. The company owns a large area in the vicinity of the mill, the ground having been located under the prevailing western practice as contiguous mining claims. Bunk houses and an office were first erected, and then work was begun on the mill buildings.

There is nothing of unusual interest connected with the excavation of the raw material, chief attention being centered in the treatment of the rock in the plant. The plant's capacity is 350 tons of mill feed per day. This amount of limestone is being developed in a new quarry immediately above the mill building, where, as may be noted in one of the illustrations, the loose overburden has been removed. Another view shows the tracks leading from this quarry site to the mill bins. One-man drills are used in the quarry. The rock is trammed in ordinary ore cars. The drills and the cars were furnished by the Ogden Iron Works.

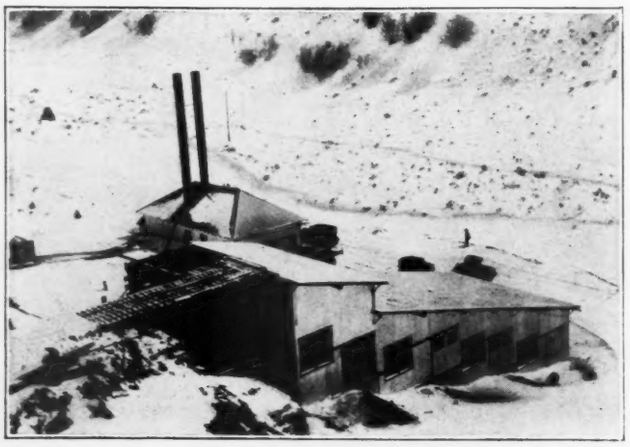
Milling Equipment and Process

Immediately below the main bin, on the upper floor of the mill building, is the main crusher, an Allis-Chalmers unit, which reduces the quarry-run rock to 1-in. size. This product, without screening, goes directly into a Centripact pulverizer. The resulting powder emerges at 150-mesh and is conveyed to storage bins.

The treatment of the stone beyond this stage



The boiler house, mill, and water-storage tank of the Little Flower Mining Company, near Logan, Utah



The ore bins and the mill, with the boiler house in the background

follows a process that was developed by W. A. Buble, the chemist for the Little Flower company. Details have not been divulged to the public, but it is known to be a wet-chemical process and it probably employs simple reagents.

The pulverized stone is charged into four large leaching tanks, where a hot solution is applied to attack and dissolve the magnesium carbonate leaving the calcium carbonate intact. The secrecy probably lies at this stage, that is, in the use of a chemical that is selective in attacking the carbonates.

The solution, after a suitable period, is allowed to drain from these leaching tanks, much after the practices employed in the hydrometallurgy of gold or copper, and it flows to large settling tanks, where it is clarified before passing to the electrolytic tanks in which the magnesium is recovered in the metallic state upon the anode plates.

The ground limestone that is left in the leaching tanks is removed, dried, and then marketed as a high-grade raw material from which to manufacture pure lime. As stated, the main product sought by the company is the magnesium, for which there is a constant, strong market. Upon the basis of 12 per cent content of this metal in the crude rock and with an efficiency of 90 per cent in its recovery, each ton that is treated will yield 216 lb. of magnesium, which is cast into 8-lb. ingots or in 3-lb. sticks and has a current New York market price ranging between 85 cents and $1.05 per pound, depending upon its purity.

On the lower floor of the mill is the boiler-room containing two Kewanee boilers which furnish not only the hot water required in the solution of the dolomite but also the heat for the plant radiators. The water for these requirements is conducted through approximately 7,000 ft. of pipe from a permanent spring which is about 1,000 ft. above the mill. The round, redwood 15,000-gal. storage tank for the water supply shows in two of the illustrations.

The crusher and pulverizer, as well as the Chicago Pneumatic compressor that furnishes air to the quarry drills, are driven by electric motors, power for which is supplied by the Utah Power & Light Company, which has erected a transmission line from Logan.

The buildings in the foreground of one illustration constitute what is known in western districts as the camp and comprise the bunk house, kitchen and dining room, wash room, office, and tool house. These buildings are heated by steam from the mill's boiler, conducted through an underground conduit, and they are electrically lighted.

F. X. Grubl, president and active manager of the company, is assisted in the operation of the plant by A. E. Harris, engineer in charge. This project is interesting, if not unique, because it involves the utilization of a raw material that occurs abundantly and is considered ordinarily a nonmetallic rock but which is treated here in a way to yield a metallic product.

The Uses for Magnesium

Magnesium is noted for the property which it imparts to its alloys with other commercial metals. It also can be put to many industrial purposes in its unalloyed state, in which it has a specific gravity one-fifth that of copper and one-fourth that of iron. It can be cast, die-cast, rolled, forged, welded, brazed, drawn, and soldered, and can be machined at high speed without lubricants.

Magnesium is a silver-white metallic-looking substance that has an increasing number of industrial uses. It is valuable in the deoxidation of other metals during refining processes. It will desulphurize nickel minerals at high temperatures. With aluminum it is alloyed up to 3 per cent to produce the high-strength castings, sheets and forgings that are in demand for aviation. It has been used for many years in pyrotechnics and as an actinic illuminant in flash-light photography.

Little Flower camp and mill site covered with deep snow

Profitable Business Depends Largely on a Successful Solution of the Personal-Relations Problem

Modern Competitive Industry Is a Conflict in Which Leadership Is Essential to Success

By ALFRED KAUFFMANN*

"ADVANCING waves of other people's progress sweep over the unchanging man and wash him out."

That statement, made by Mr. Kettering of the General Motors Corporation several years ago, is as true to-day as it was thirty-five years ago when, as a boy, I entered the shops of the General Electric Company at Schenectady, New York. During those thirty-five years, four were spent in machine shops as an apprentice, three years as a student in engineering, and twenty-eight years with the Link-Belt Company. With that as a background, I hope with some degree of interest to tell you about some trends in industry.

But before we dwell on the present-day situation, let's project ourselves back to the workday of 1894 and thereabouts, when we passed through the check-in gate at seven in the morning and out again at six in the evening, with one-half hour for lunch. Those were the days when the workman bought his own wooden wash pail, soap and towel, which he kept under his bench, and hauled out a few minutes before quitting time provided the foreman or "super" wasn't looking. If luck was with you, you got home by seven; if you missed your car, no telling when you reached home. There were compensations, however; if you were tired and needed a little nap, all you did was to set your planer, shaper or lathe to cut the air, and your buddy tipped you off when the boss's feet were heard. No piece work, bonus or premium. Some contract work in rare cases, but mostly a flat day rate, and not so very much of that. Quantity and high quality of employee production at lowest possible unit cost meant nothing to the average employee then. He knew little of the customer's side of the picture, seldom shared in any of the gains, consequently was interested only in putting in a day's work. Of course, some of us boys made a little money on the side which helped swell our weekly pay. We carried lunches and beer to the men. A long pole in each hand held about twenty pails, so you can figure yourself what we made.

Alfred Kauffmann

And in those early years we had every so often our nice little strikes because one or the other of us didn't want to do this or that, and, as we all sympathized with each other, we quit, sulked, lost our pay, and finally came back, all because the fellow that hired us thought he was boss and we thought we were boss—when all the time neither of us was boss—but we hadn't learned yet that "the buying public is the boss of us all." No matter what position we hold—workman, foreman, superintendent, manager, president, or what not—let us fail to give or to make good products, then see how quickly we'll be called to account for our work by the buying public.

Of course, the waves of progress taught us that millions were wasted in unnecessary strikes, we also learned that many losses were due to neglect on the part of the manufacturers to give the same consideration and attention to the human element of their factory as they gave to their machinery. The employees learned also that the employer was their agent who found purchasers for the product of their labor. So between the two we learned that many years of labor were needed in order for a worker to recover his wasted savings or for the manufacturer to replenish his loss.

"Treat 'em rough, and tell 'em nothing" was not very far from the true relationship between management and employees in manufacturing plants in the early days. The underlying point of view was that a firm hand, together with a withholding of all except the most meager information about the business, was necessary in successfully handling factory men.

To-day, just exactly the opposite views are held by executives whose function is the handling of employees. Men to-day want to know what it's all about. They are intelligent enough to comprehend the facts and to use them constructively, and it's good business to give them the information.

* President, Link-Belt Company. An address delivered June 8, 1929 before the Sixth Annual Convention of the National Association of Foremen.

Old customers are the backbone of any business. If we keep them satisfied with price and quality and delivery we will have less customer turnover. When these facts are brought home to employees, it will stimulate them to appreciate that their performance has a direct bearing upon the marketability of the product. Losses and wastes invariably are reduced by the arousal of interest. So I say again, consider the factory employees as part of the sales force and tell them everything.

The White-Collar Complex

It hasn't been so long since we wiped out the white-collar complex — the false barriers between office and factory employees, which used to worry many executives. What was more galling than to have an office man walk through the shop and look down on the man in overalls? And when it came to sports, like baseball, golf, or any other games, can you picture a white-collar man from the same company playing on the same nine, or in the same foursome? But time has brought a democracy in manufacturing organizations which has changed all this.

It wasn't an overnight job. It has been a long time developing. It has grown so slowly that some of us little appreciate both its present extent and its possibilities for good in modern management. So during all these years in which the waves of progress have swept on and made a distinct evolution in industry and industrial management the unchanging man has always been washed out of the picture.

Modern business is organized in such large units to-day that, in an ever-increasing number of cases, men, who twenty-five or thirty years ago would have been in business for themselves, are to-day important factors in large corporations. Men with high qualifications devote their talents to marketing, production, accounting, or some other phase of the company's business; but irrespective of its many ramifications, the fundamental principles underlying business success are few in number and simple in character. To start with, the object of being in business is to make profits, and the index of success is the ratio of the profits actually earned to the real profit-making possibilities of the business.

Having determined what these profit-making possibilities are, the next step is to ascertain what causes contribute to failure to realize these potential profits. We must find out to what extent this failure is due to manufacturing inefficiencies, to excessive sales costs, to short-sighted or incorrect company policies, to defective accounting methods, to ineffective or inadequate advertising, or to still other conditions.

Management's Responsibility

Bear this in mind: Mergers of small companies into one large company provide no substitute for competent management. After they are set up and operating as a unit, their earnings, as in any other form of business, depend entirely on the sound judgment and foresight of the management. But with big business and mergers an entirely new condition was created. Industry, instead of belonging to the privileged few, is passing into the hands of the many. To-day there is an army of employee-owners in every large organization. Does not this put an added responsibility on the management? The passing of a dividend becomes a serious matter, if the action hits the pocketbooks of the workmen, foremen, superintendent and company officers. Also, workers who are now part owners of their companies are beginning to have a better understanding of the duties and difficulties of management.

Now what part do we play in this picture? Most of us in this room are interested in the manufacturing end. What proportion of the failure to get the best out of our plants can be "pinned" on us? We all know that an industrial plant is only a mass of junk, unless some one is around to see that the bricks, mortar and machinery become tools of production. And that takes human beings. There may be all kinds of trends in industry—mergers, consolidations, and what are sometimes called vertical trusts—or history may bring about the cutting up of the big units into small ones again, but what will always be needed will be men to do things. Men are not such certain quantities as money, materials and machinery. A machine will do a known quantity of work in a known time. A man will do such work as he is willing and able to do.

Men, then, are the most important factors in the conduct of any business. And what difference does it make whether we mention this before a gathering of foremen, salesmen or executives, when the cry is always the same. Forget the title tacked on to our names and look at it from the big opportunity standpoint. Men grow by having responsibility laid upon them. You may be a foreman to-day and a superintendent or manager to-morrow. The same applies to the workman under you. In a sense you are his manager. Encourage him, let him know that he has a chance to get ahead, and that his chance lies in himself, and you will get further than any scheme of profit sharing, bonus, or welfare work, though they all may be very helpful. The chance to say "Yes" to the question "Am I getting on?" is what appeals to most men.

You men here who are foremen, are you not the business managers of your departments? Would you or could you do differently than you are now doing, if you were able to put your department in a separate building, on a different lot, and put a sign with your name over the door?

You were not picked because you had a "pull." As business manager of your department you were

chosen because you had certain definite qualifications—you were a good workman, a master craftsman; you understood the "know-how" of the business, and you know how to get along with people.

You know better than I do the many petty things that come up during the day or week, the burden of which must be borne by you. You know the most important factor is maintaining high quality and low cost. Why tell you anything about the direct loss due to spoiled work, or that rush jobs are always more expensive than regular jobs?

Selling the Job to the Worker

You need new men in your shop. Either you, the foreman, or the employment man must hire them. Both of you are poor salesmen if you can't sell the job to the prospect, because, remember the man who asks for employment is a buyer of a job, and if you need him it is your business to sell him one.

Some of you may, but all of you should, know more about the practical knowledge of manufacturing economies and accounting, have a clear insight into such overhead items as equipment depreciations, tool cost, scrap charges, supply costs, supervision and inspection charges, and the like in their relation to direct charges and total costs. But more important than all is a working knowledge of human beings.

Bear this in mind: Every man pays for the amount of bossing he requires and, likewise, every man's wages increase in proportion to his ability to act as a boss or foreman of himself and others. The lower the wage rate, the greater the amount of watching and direction constantly required. The highest wages are paid to the man through whose ability the largest number of other men may be profitably employed.

I want to say this in conclusion: Competitive industry to-day isn't a social or charitable affair; it is a conflict, and leadership is required to bring success. It takes "guts" to stay in the game. Some of us who handle men succeed only in proportion as we intelligently direct the work, that is, as we get intelligent work from the men who work with us.

So I repeat what I said at the beginning: The opportunity is here; if we don't take advantage of it, then the advancing waves of other people's progress will sweep over us and wash us out.

Pit-and-Quarry Operations In Colorado

In the 1928 annual report of the Colorado Bureau of Mines John T. Joyce, commissioner of mines, states that the operation of non-metallic mines and quarries during the past few years in Colorado has developed into one of the state's most important industries. Any demand for building or monumental stone of every kind, such as granite, marble, or onyx, can be fully supplied from the stupendous stores in various parts of the state. Many quarries have been opened along the eastern mountains, the Arkansas and Platte rivers in Gunnison, Pitkin, and other counties of the western slope. Building sands and gravels are found in abundance along all rivers and streams.

The clay deposits of Colorado for all purposes are unexcelled. It is highly improbable that any desired industrial clay could not be found within the state's confines. Feldspar, fluorspar, bentonite, sillimanite, lime, gypsum, and the like are found in large quantities. Enormous oilshale deposits, also bitumen, asphalt and tar sands, exist in several of the western counties. Mica, jefferisite, muscovite and other insulating materials are widely distributed throughout the state.

During the past year 65 quarries and pits were in active operation in Colorado, producing upwards of $2,500,000 worth of products, and giving employment to hundreds of men. In addition to many varieties of clay, these pit and quarry operations included the following minerals: limestone 17, granite 8, marble 3, sandstone 3, slag 2, cement rock 2, jefferisite 2, travertine 2, and one each of quartzite, feldspar, silica, dolomite, shale, bentonite, fuller's earth and gypsum.

Uses for Talc

A report recently issued by the United States Bureau of Mines, Department of Commerce, enumerates a number of uses of talc in addition to its extensive employment for facial beautification purposes.

Powdered talc and soapstone, the report points out, are used extensively in the paper, paint, roofing, rubber, foundry and textile industries and for toilet preparations. Massive talc of the variety known as "lava" grade, free from iron and grit, with no cracks or cleavage planes, is cut into gas tips, blanks for electric insulation and spark plugs. Only small amounts of this variety are produced in the United States.

Massive soapstone is manufactured into laundry tubs, trays, sinks, laboratory-table tops, store fronts, bus-bar compartments, electric insulating material, acid tanks, stair treads, furnace blocks, fuse guards, tiles, aquariums, switchboards, panel boards, bases, insulators, wainscoting, fireless-cooker stones, hearth linings, furnace linings and griddles.

New York produces approximately half the talc mined in the United States. Vermont, California and Georgia also produce considerable quantities. The entire soapstone output of the country comes from Virginia.

Rapid Welding Progress Revealed by A. W. S. Fall Meeting Program

Continued rapid expansion of welding applications, backed by extensive research activities, is revealed in the preliminary distribution of the Fall Meeting program by the American Welding Society, 33 W. 39th St., New York City. As previously announced, this meeting is to be held in Cleveland, Ohio, September 9 to 13, with morning sessions at the Hotel Statler and afternoon sessions and extensive exhibits at the Cleveland Public Auditorium.

Because of the mass of important material available, it has been necessary to increase the technical sessions to six this year and to allow more time for reports of important research projects. No less than nine research papers will be presented, three of them dealing with newly discovered nondestructive tests of welds. One of these tests, based on electrical conductivity, is the discovery of Elmer Sperry, well known inventor and president of the American Society of Mechanical Engineers. The second involves the use of the stethescope and third X-ray methods.

Other research papers cover "nitrogen needles," electric welding by the carbon and metallic arcs, special metallo-graphic studies, stress-strain characteristics of welded joints and the use of X-rays in examining welds.

Two papers will deal with the welding of boiler tubes and drums, the tubes of mercury boilers, etc. Other subjects covered by technical papers include gas welding of steel buildings, automatic welding of thin sheets, welding of pipe lines, replacement of castings by welding in machine construction, and the welding of copper alloys and high-strength aluminum alloys.

In addition to the nine research papers three special sessions will be devoted largely to research. A meeting of the Bureau of Welding will deal with a variety of research projects. The meeting of the Structural Steel Welding Committee will record advances in that fast-developing field. A special conference of college professors and other research workers will be called to discuss welding research and further the co-ordination of activity along this line.

Those attending the A. W. S. Fall Meeting may profit also by the sessions of the American Society for Steel Treating, the Iron & Steel Division of the American Institute of Mining and Metallurgical Engineers, the Institute of Metals Division of the American Society of Mechanical Engineers, which are meeting simultaneously in Cleveland during the week of September 9. The cooperation of these groups makes possible a great exposition in the Cleveland Public Auditorium, where more than 275 manufacturers will exhibit the latest equipment, supplies and methods for the manufacture, working, treating, welding and use of every kind of metal. More than 80,000 square feet of floor space will be covered by these exhibits.

Granite Men Were Guests of Rockport Firm

Members of the National Building Granite Quarries' Association and the Granite Paving Block Manufacturers' Association of the United States, Inc., were the guests of the Rockport Granite Company at a Cape Ann, Mass., Clam Bake Friday, at the property of the company, known as the Farms Quarry, bordering on the ocean at the extreme point of Cape Ann.

Members of the associations were present from Georgia, North Carolina, New York, and all states in New England, most of them coming by automobiles to see Cape Ann at this season of the year, and enjoy one of A. H. Roberts well-known clam bakes.

While the formal conventions of the associations are held jointly at various places during the winter months, informal meetings and get-togethers are held during the summer at various localities. About 100 were present.

A ball game and various sports were carried on before the bake, after which trips were made around the top of Pigeon Hill, one of the highest elevations on the Cape, from which a most delightful view can be obtained of all Cape Ann.

Many prominent guests of the engineering and architectural field were also present. Members of the Rockport Board of Trade were on hand with their circulars, and from the complimentary remarks made by the guests, undoubtedly Cape Ann will be visited by many of them in the future. "Joe" Tobin, field secretary of the Granite Paving Block Manufacturers' Association, was master of sports, and entered into the spirit of them all, especially the ball game. He was overcome, however, in running to first base, and required the services of the Boy Scouts Ambulance Corps, which rendered first aid.

C. Harry Rogers of Rockport is perpetual president of the Granite Paving Block Manufacturers' Association, having held the position since organized, 15 years ago. James J. Tobin is field engineer, Guy Swenson of the John Swenson Granite Co., Concord, N. H., is president of the National Building Granite Quarries Association, and Harrie H. Sherman of Boston, is the secretary.

How the Finishing Lime Association Gets Its Message to the Public

By L. E. Johnson, Secretary, The Finishing Lime Association of Ohio, Toledo, O.

LIMESTONE is one of the most widely distributed natural deposits of rock which occurs in the United States, and this wide distribution has brought about a large number of producing units whose product comes under the general name of "lime."

The development of lime has naturally been a slow one as compared with other industries. This has been due largely to the fact that through this wide distribution of lime rock, in the early days of this country, small producing units were built, each one supplying the demands of the immediate surrounding territory; often times the output being not over 50 to 100 bushels per day delivered directly to the job from the kilns.

With the development of the railroads, the markets for lime became slightly wider, but it still remained a localized industry, long shipments not being possible, due to the perishable quality of lump lime.

Along about 1900, hydrated lime made its appearance on the market, it being discovered that lump lime could be hydrated at the plant, bagged, and sent to the consumer ready for use, no slaking being necessary, and thus eliminating all dangers attendant upon the use of lump lime. As all the plants were able to manufacture hydrated lime, the markets still remained localized.

At this time, all lime was considered as lime, no attempt being made to classify it as regards the properties, characteristics, uses, and limitations, which differentiate one lime from another. It was early discovered, however, that the hydrated lime produced in the small area of northwestern Ohio had properties and characteristics which made it entirely different from any other lime produced, and thus came into existence the finishing hydrated limes from Ohio. Due to their particular adaptability for plastering purposes, they early received an acknowledgment of their superiority, and their markets began to widen, until a national distribution was attained.

At the present time, over 50 per cent of the hydrated lime used in the United States comes from the state of Ohio. Finishing hydrated limes from Ohio are shipped into every state of the Union, and several foreign countries, the longest shipment being a cargo to Australia. Thus it can be seen, while the lime industry in general may be called a localized industry, the finishing hydrated lime industry of Ohio is a national one, the markets are limited only by distribution facilities.

The properties and characteristics which give the finishing limes of Ohio world-wide acknowledgment from architects, contractors, and journeymen, are their high strength; mortars made from magnesium limes being three times stronger than mortar made from high calcium limes, (Proceedings A. S. T. M. 1914); their high plasticity or workability, and their uniformly white color, and the low shrinkage when they have been used in form of the finishing coat of plaster.

The efficiency of any lime both as to quality and economy is measured by its workability, which is inversely proportional to the shrinkage, and as the shrinkage of a lime is directly proportional to the calcium contents, it can be seen that the magnesium finishing hydrated limes from Ohio, having a comparatively low calcium content and a high degree of workability, are eagerly sought and used by the discriminating and high-class architects and contractors throughout the country.

A great deal has been said in the past relative to the statement that all limes regardless of chemical composition are applicable for construction purposes, and that the measure of a lime is the amount of yield in putty which it has. This is entirely erroneous, misleading, and false reasoning. The amount of yield in putty that a lime has determines the amount of shrinkage it experiences, that is, the larger the yield, the greater the shrinkage; and it follows that the greater the shrinkage, the lower the strength. Also the greater the shrinkage, the more gauging is necessary in plastering work, and of course, it follows, that the more gauging that is used, the less coverage is obtained and the higher the cost.

Contractors are becoming familiar with the truth that in purchasing lime they actually purchase yardage and safety rather than tonnage and hazards. With the development of the national markets for finishing hydrated lime, the manufacturers in Ohio early improved their manufacturing plants, until they are the most modern in existence, and the finishing hydrated lime industry has passed far beyond the localized and primitive lime plants which were in existence when all lime was manufactured only for the local market. The plants are all operated under chemical control, and the product is a highly refined one; all impurities being removed and all of the attendant dangers which menace the architect and contractor when quicklime is used have been eliminated. Therefore, finishing hydrated lime from Ohio can be classified as a high magnesium or dolomitic lime, whose properties and characteristics make it particularly adaptable for plastering purposes, and which are derived wholly from the deposit of rock found in northwestern Ohio.

There is only one deposit of this rock in the world, and while other lime manufacturers have attempted to produce a finishing lime through refinements of manufacture, they have not been able to do so, as the qualities and characteristics which make a finishing lime are found only in the rock.

In 1926, the leading manufacturers of finishing hydrated lime from Ohio realizing that, in the new age, their competition comes from without the industry rather than from within, and appreciating the great truth that greater good may be accomplished through group effort than through individuals, organized and formed the Finishing Lime Association of Ohio, the membership of which consists of the following companies:

The Kelley Island Lime & Transport Co., Cleveland, O.

The National Lime & Stone Co., Findlay, O.

The National Mortar & Supply Co., Pittsburgh, Pa.

The Ohio Hydrate & Supply Co., Woodville, O.

The Woodville Lime Products Co., Toledo, O.

The Gibsonburg Lime Products Co., Gibsonburg, O.

The Association maintains headquarters in Toledo, O., and operates with seven district offices, each one in charge of a capable and experienced engineer.

These district offices with their personnel are as follows:

A. P. Bick, Chicago, Ill.; F. J. Spayth, Detroit, Mich.; L. W. Lay, Pittsburgh, Pa.; L. A. Craig, St. Louis, Mo.; E. M. Allen, New York, N. Y.; C. R. Smith, Philadelphia, Pa.; W. S. Hay, Atlanta, Ga.

The work of the Association is carried on in the field by the district engineers and consists of purely promotional and educational activities. Calls are made on architects, contractors, and journeymen, for the purpose of informing them as to the proper methods, the adaptability, and the limitations of the use of finishing hydrated lime in construction.

Standard specifications have been written for plastering as well as a series of informative bulletins on the use of their product. A code of ethics and marketing policies have been adopted, and cooperation extended to the building supply dealers throughout the country.

Moving picture films have been taken of the manufacture of finishing hydrated lime from the opening of the quarry to the finished wall. These are shown to organizations interested in the plastering industry throughout the United States. The Association also concerns itself in new developments, new uses for lime, classifications of limes, and research.

Membership is maintained in the following organizations:

The Producers' Council.

The American Society for Testing Materials.

The American Concrete Institute.

American Engineering Standards Committee.

The Building Officials' Conference.

As evidences of the quality of finishing hydrated lime, such buildings in New York City as the New York Central Office Building, Chanin Building, Chemical National Bank Building, and all state buildings in New York state have been finished with finishing hydrated lime from Ohio. It will be found that structures embodying the best architectural talent, and where the quality of materials of paramount importance, are always plastered with finishing hydrated lime, which clearly shows that finishing hydrated lime from Ohio has a nation-wide acknowledgment as to its superiority.

All finishing hydrated lime produced by members of the Finishing Lime Association of Ohio is of highest quality, one of the requirements for membership in the Association by manufacturers being that their lime meets the requirements of the A. S. T. M.

Ocher, a Mineral That Helps Fill the Paint Can

Ocher or ochery earth is a natural mineral pigment composed largely of clay permeated with iron (hydrated ferric oxide). Its color ranges from yellow through orange to reddish brown, depending largely on the amount of iron present. Ocher grades into sienna, which differs from ocher in that it generally contains more ferric iron than it does clay, and in that, when finely ground, it is more used in stains than in paints. Good grades of ocher should contain 20 or more per cent iron oxide, but the iron content of the material marketed varies widely. Ocher has a specific gravity of about 3.5.

There are two principal uses for ocher—in paints and as a filler for linoleum and oil cloth, states R. M. Santmyers, mineral specialist, Bureau of Mines, in a report just issued on the subject. Ocher is used to a limited extent as a pigment in coloring cement stuccos and mortars, for producing desired colors in earthenware when mixed with manganese oxide, and in very limited quantities for other minor uses.

Ocher is produced more or less regularly in the following states named in order of importance: Georgia, Pennsylvania, Virginia, Alabama, California, Iowa, and Vermont. Deposits have been found in other states but are not known to have maintained any important production. In the Pacific Northwest, however, certain deposits, notably in western Washington, are believed to be of considerable potential importance commercially.

Georgia is by far the leading producing state. There are no official figures of production but, according to estimates of several producers, the annual output is in the neighborhood of 15,000 tons, practically all of which comes from the Cartersville district, in Bartow County.

Cream ocher contains as low as 5 per cent iron hydroxide. It is used to some extent as a primer on wood, but has little value as a pigment. Gray ocher is silica, clay, and carbonaceous matter. Sometimes it is colored slightly green by a trace of ferrous hydroxide. It is used as a filler for cheap paint. White ocher is nothing but ordinary clay, and has no value in paint, although it is occasionally used as an adulterant.

Golden ocher is ocher which has been toned up with some chrome yellow. Various shades of it are on the market. Perfect orange-colored shades contain as much as 12 to 15 per cent chrome yellow. The base may be either French or domestic ocher.

Green ocher is similar in composition to gray ocher except that it contains a larger proportion of ferrous hydroxide. It is found principally in Bohemia (Czechoslovakia), and goes by the name of "terre verte." It has no hiding power when used alone in paints, but it has a high absorbent capacity for certain aniline colors. Verona green, Veronese earth and green earth are similar products.

Red ocher is obtaining by calcining raw ocher at a low heat so as to drive off a part of the combined water. The shade depends upon the time of heating and the iron content—the longer the calcination the more purple the product. Burnt ochers are sold as Indian red, Venetian red, and light red. As a rule, these ochers are much richer in iron than the ordinary ocher, which almost never contains more than 30 per cent iron oxide.

Georgia ocher has been used chiefly as a filler in the manufacture of linoleum and oil cloth, and much of it has been exported to England and Scotland for that purpose. Some of it is used for the same purpose in this country. It is also employed in the manufacture of paints, and in a variety of minor ways. This ocher when calcined yields a red pigment which is becoming of importance, especially as a mortar color, and is finding its way into the markets in growing quantities.

Ocher has no substitutes in the sense of similar cheaper products, since it is the cheapest of the common yellow pigments and competes, especially in the golden grades, with more expensive products like chrome and zinc yellows. Artificial ochers, of composition somewhat similar to that of natural ocher, and yellow clay mixed with more or less ocher, are used to a limited extent in the cheaper grades of linoleum. Powdered slate and ground shale are now actually preferred by certain linoleum and oil-cloth manufacturers.

The preparation of ocher for market is ordinarily quite simple, involving merely a rough mechanical separation of the ocher from impurities that may be mixed with it. The sequence of processes is essentially similar in all districts and includes washing, drying, pulverizing, and packing. The purpose of washing is primarily to rid the product of sand, small stones, and other foreign matter which may be associated with the ocher in nature or which has been mixed with it in mining. The washing process, however, since it thoroughly mixes the ocher, enables a more uniform product to be prepared. Sometimes it is also possible to improve the color or to produce minor modifications in the shade.

Further details are given in Information Circular 6132, "Ocher and Ochery Earths," copies of which may be obtained from the United States Bureau of Mines, Department of Commerce, Washington, D. C.

Road Withdraws Plea

The hearing before the Corporation Commission of Virginia on a petition filed by several railroads to increase freight rates on lime and ground limestone terminated July 23, when the petition was withdrawn by W. N. McGehee, counsel for the Southern railway.

The withdrawal of the petition by counsel for the Southern Railway apparently met with no objection, under the circumstances, from the attorneys of other railroads present.

The session was attended by a large gathering of Virginia farmers, manufacturers of limestone products, state officials, and attorneys for interested railroads. It was a proposed hearing on a petition filed some time ago by counsel for the carriers asking that freight rates in Virginia on lime and ground limestone be raised to conform with an order that has been entered by the Interstate Commerce Commission in a case in which the North American Cement Corporation was complainant, cited as I.C.C. docket No. 19943, and generally termed the "West Virginia Case."

The order of the Interstate Commerce Commission in question, it is understood, directed an increase of rates, intrastate in Virginia, as to shipments of lime and ground limestone, originating at six specified points, which were Staunton, Ripplemead, Eagle Mountain, Indian Rock, Strasburg and Riverton.

Counsel for the Southern railway, in an opening statement, took the position that the order of the Interstate Commerce Commission, as to the six points of origin recited would by him be considered as paramount to the authority of the State Corporation Commission of Virginia and, on this assumption, announced that he would construe the petition that had been filed as referring only to points not within the purview of the I. C. C. order.

If, however, the petition of the railroads was to be taken as including the six Virginia points of shipping origin, Mr. McGehee intimated, he would ask leave to amend the petition forthwith.

The commission, however, was not inclined to grant the request for amending the petition summarily, and the motion was denied.

Mr. McGehee then withdrew the petition, and stated that he would, at a future day, submit a revised petition, dealing only with rates as to points not already covered by the I. C. C. ruling.

The withdrawal of the petition brought to a conclusion a session of the State Corporation Commission that had been expected to take up all of that day, and possibly a second day, since the proposed hearing had stirred up a great deal of interest among farmers of the state who have seen in the possible rate increase a source of much economic detriment to the problems of agriculture, and many organizations had sent representatives to the hearing who, on their behalf, presented petitions of protest.

Meanwhile, the State Corporation Commission, through its commerce counsel, H. E. Ketner, has forwarded to the Interstate Commerce Commission a second petition calling attention to the need of farm relief, to the advantage accruing to Virginia farmers as a result of the rather low freight rate now prevailing on the lime products intrastate here, reciting the belief that the change contemplated by the I. C. C. order would be a detriment to Virginia farmers without a benefit to interstate shippers, and asking that a rehearing be allowed of the "West Virginia case."

Increased Production Fuller's Earth in 1928

The fuller's earth sold or used by producers in the United States in 1928 amounted to 287,012 short tons, valued at $3,895,991, it is announced by the United States Bureau of Mines, Department of Commerce, which has collected statistics in cooperation with the Geological Surveys of Florida, Georgia, Illinois, and Texas. This is an increase of 9 per cent in quantity and 3 per cent in value compared with 1927. Every producing State except Georgia showed an increase, and one State that has not reported production for many years—Colorado—reentered the list of producers. The output was reported by 17 operators in 8 States in 1928, namely, Arizona, Colorado, Florida, Georgia, Illinois, Massachusetts, Nevada, and Texas. Georgia was the leading State in production in 1928, with Florida second and Nevada third. These three States produced 77 per cent of the total output. The average value per ton of fuller's earth was $13.57 in 1928, compared with $14.24 in 1927.

Fuller's earth is a term used to include a variety of natural substances that possess the property of absorbing grease or clarifying, bleaching or filtering oil. They are mostly clay-like substances, though recently discovered material in the West, which is of different character, is said to be of excellent quality. The original use of fuller's earth was in the fulling of cloth, but little of it is now used for this purpose. It is used almost exclusively in the bleaching or filtering of mineral and vegetable oils, and animal fats, 98 per cent of the domestic output being used for these purposes in 1928; the remainder was used as a filler, a binder, for fulling cloth, etc.

Until 1895, when fuller's earth was successfully produced commercially in Florida, the United States was entirely dependent on foreign supplies. In 1928 the imports of fuller's earth were 7,592 short tons, valued at $132,003, practically the same in quantity, but an increase of 21 per cent in value compared with 1927.

The exports of fuller's earth are not separately shown in the official records of the foreign commerce of the United States, but 8 producers reported to the Bureau of Mines that in 1928 they exported 16,494 short tons of fuller's earth, which was an increase of 34 per cent over 1927.

U. S. to Exploit Phosphate Deposits

Congress has made available $50,000 a year for the next four years to be used in developing the potash deposits in the United States. This work will be done jointly by the departments of agriculture and commerce. The farmer has additional funds of $25,000 a year for investigations it started in 1911 in connection with the United States Geological Survey. At that time America was dependent entirely on the German monopoly for all the potash used in agriculture.

J. W. Turrentine, in charge of potash investigations for the Department of Agriculture, looks hopefully toward the vast, flat-topped buttes of Wyoming that are made of volcanic lava and contain leucite, a potash ore.

Another ore, glauconite, is contained in the enormous green sand deposits from the Rariton base southwest to the Delaware river in New Jersey. Other potash sources are the shale deposits in northern Georgia, the alunite in southern Utah, and the feldspar that occurs in almost all of the United States.

Byproducts for which various commercial manufacture are sought and which occur in almost all the potash deposits include iron oxide, alumina and silica.

More than 13,000,000 tons of granite and limestone were used on British roads last year.

Water Cooling Systems for Steam Turbine Condensers

By C. R. Kranze*

THE portland cement industry, ranking high among the largest producers and consumers of power, is confronted with the same problems of power generation as the public utility plant. With the rapid adoption of the modern steam turbine, most of which are operated on a condensing basis, one of the problems before the plant engineer is the question of cool circulating water for steam condensing purposes. The ideal power plant site is one adjacent to some natural body of water which can be drawn upon in unlimited volume for condensing purposes, providing such supply is free from contamination or scale forming substances. Unfortunately most plants are not favored with these ideal conditions, so that it then becomes necessary to cool and use the same condensing water supply over and over again, adding thereto the necessary "make-up" supply to compensate for losses due to evaporation and drift. 1½ to 2 per cent is generally sufficient to compensate for all such losses in the properly engineered water cooling system.

While there are several methods of meeting the water cooling problem, such as the installation of natural or forced draft cooling towers, this article deals with the modern spray cooling pond, which, because of its enormous capacity, high cooling efficiency, low first cost, operation, and maintenance, is about the only practical solution to the problem in these days of tremendous turbine and condenser sizes. The accompanying diagram shows a typical spray cooling pond with reference to the steam turbine, generator, condenser and circulating pumps, showing the correct arrangement of nozzles, piping, spray manifolds, and pond dimensions for a spray cooling system of given capacity. This general style and arrangement of the cooling system is typical of several hundred cooling plants which have been designed, installed, and supervised by the author and have been found by test to produce the greatest overall cooling efficiency in practically every section of the United States and in many foreign countries.

The photographic illustration shows a spray pond in operation at the plant of the Colorado Portland Cement Company, Boettcher, Colo. Similar installations have been made for the Sandusky Cement Company, Sandusky, Ohio, Sandusky Cement Company, York, Penna., Monarch Portland Cement Company, Humboldt, Kans., and many others in the cement industry. In the field of strictly power generation, also industrial plants producing their own power in a wide range of industries, thousands of spray cooling ponds are in daily operation throughout the country.

Spray Cooling Ponds Vs. Towers

In many plants cooling towers are the only practical solution due to space limitations, and this applies to either the natural or forced draft commercial design tower. First cost, operation, and maintenance in either type of cooling tower construction greatly exceed that of the spray cooling pond, first because of the height which the water must be pumped to the top of tower, and, in the case of forced draft towers, the power cost of operating enormous fans must be reckoned. In the spray cooling pond an ordinary concrete basin is all that is required. Over this is mounted the spray cooling system, consisting of the distributing piping, spray nozzles, spray manifolds and fittings. The cost of piping water to the nozzle installation is generally less than one-half the pumping cost of a cooling tower of

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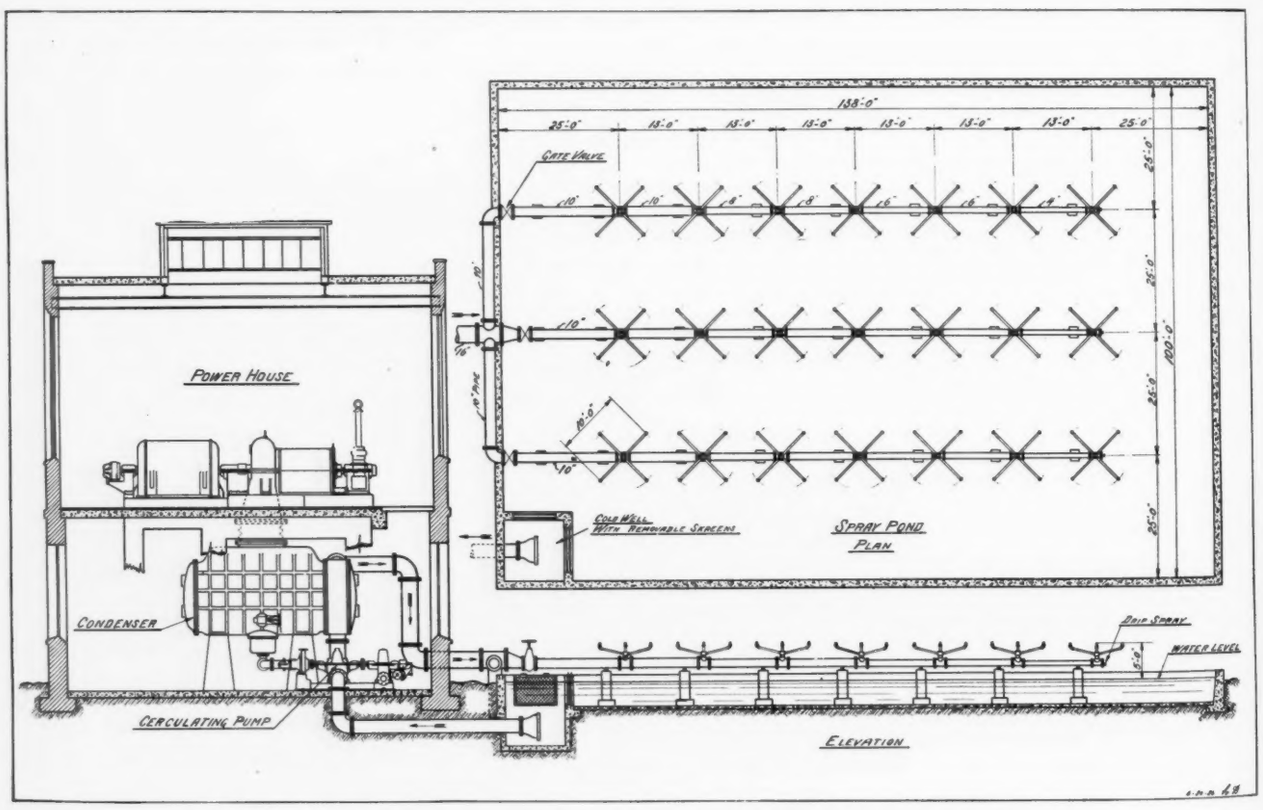
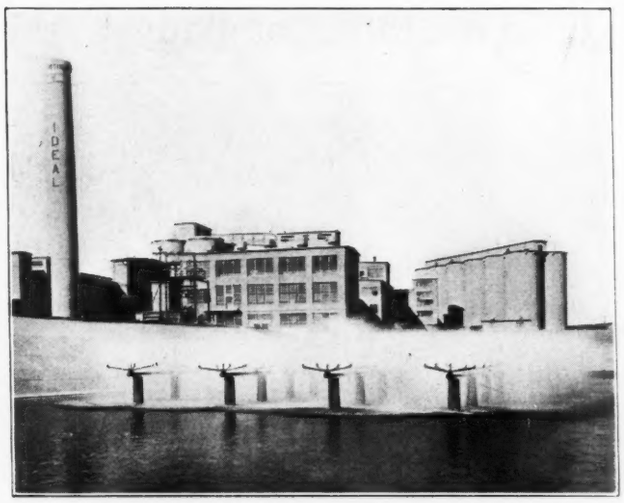


Typical arrangement of spray cooling system, capacity 4,200 g.p.m. at 7 lb. pressure

equal capacity, due to the fact that the uppermost point of discharge is represented by the nozzles which are only elevated 5 feet above the maximum water level of the pond, plus a nozzle pressure of 7 pounds, corresponding to a 16-foot head. No materials are employed in the spray cooling pond which can rust away, become water logged, or blown over as is the case with cooling towers. Generally a spray pond will outlast the plant and frequently will show no appreciable deterioration after ten years of continuous service.



Colorado Portland Cement plant at Boettcher, Colo.

Selection of Spray Cooling Systems

No matter how carefully the system may otherwise be designed, it will in most cases be no more efficient than the nozzles employed. Where the temperature rise in the circulating water passing through the condenser system ranges from 16 to 20 deg., 2-inch nozzles should be used, while for lesser temperature ranges the 2½-inch size will be found satisfactory. Spray nozzles should be of the non-clogging type, but for best results they should discharge the water in a full mass conical spray of approximately 85-deg., including angle. Nozzles of various designs are available. Those constructed of one piece, wherein the water enters the nozzle eccentrically with reference to the discharge orifice, thereby setting up a swirling motion at the point of discharge. This type, while fairly satisfactory, generally will not produce an overall cooling efficiency equal to nozzles designed with a central core, due to the fact that in the cored nozzle a full mass spray formation is secured rather than a hollow conical sheet of water peculiar to the so-called centerless type of cooling pond spray head.

Aspects of the Spray Cooling Pond

While the author wishes to refrain from complicated technical discussion, a few simple points from an engineering angle are advisable. First, all cooling systems, irrespective of design or construction, have their limitations, as the final temperature which can be secured in the circulating water is determined by the outside air temperature, humidity, and finally the wet-bulb temperature, which is the measuring stick by which all cooling systems are judged. Any cooling system capable of reducing water to the wet bulb temperature would operate in terms of cooling efficiency at 100 per cent. It then follows that the cooling efficiency of any system can be arrived at by the following formula:

$$\frac{T_1 - T_2}{T_1 - T_3} = \text{Efficiency per cent}$$

Where:

T_1 equals temperature of water leaving steam condenser.

T_2 equals temperature of water after passing through cooling system.

T_3 equals temperature of the wet bulb thermometer as determined by the ordinary sling psychrometer.

This formula, as will be noted, simply divides the theoretical range into the known range which expresses the cooling efficiency of any system. With a normal air temperature of 70 deg., humidity of 70 per cent, corresponding to a wet bulb temperature of 63 deg., any properly designed cooling plant should produce an overall efficiency of 60 to 70 per cent when working through a normal temperature range of 16 to 20 deg.

Arriving at Circulating Water Requirements

Assuming a plant of 5,000 kw. capacity with a normal steam consumption of 15 pounds per kw. hour, this would require a cooling system proportioned to condense steam at the rate of 75,000 pounds per hour. The problem is then one of a study of atmospheric conditions for the purpose of determining the feasible temperature rise which can be properly dissipated in the spray pond under existing conditions, and simmers down to a ratio of cooling water per pounds of steam to be condensed. Water ratios and effect on vacuum are of extreme importance and one should be selected which will produce the maximum feasible degree of vacuum consistent with fuel costs, atmospheric conditions, etc. For all practical purposes a 60 to 1 ratio will be found about right, meaning 60 pounds of water for each pound of steam condensed, which ratio will result in a temperature rise of 16 deg. in the circulating water. Circulating water requirements may be calculated by using the following formula:

$$\frac{\text{Kw. rating of plant} \times \text{g.p.m. of steam per kw. hour}}{500} = \text{circulating water}$$

500=weight of water at 8.3 pounds per gal. × 60 minutes.

Cooling Results

The following cooling table is typical of a spray pond designed on a 60 to 1 ratio, showing the initial and final temperatures under various atmospheric conditions, together with the probable vacuum, assuming that condenser tubes are free from scale and that there are no leaks in the condenser piping:

Air Temp.	Rel. Humidity Pct.	Before Spraying	After Spraying	Vacuum Deg.
60	70	81	65	28.75
70	70	90	74	28.27
80	70	100	84	27.68
90	70	109	93	27.05

Power Required for Operation

No definite general statement can be made as to the exact requirements other than averages and this can be assumed for all practical purposes at approximately 1½ per cent of the total power generated by the prime movers it serves.

Gravel or Crushed Stone in Concrete

Mixtures of 1:3:3, cement, sand, coarse aggregate were made to compare relative strength advantages of natural gravel or crushed stone in concrete. In the case of concrete of the usual characteristics, gravel and crushed stone have practically the same value in concrete with reference to the strength and density of the product, assuming that the gravel or crushed stone are of the same variety of rock and have in themselves the same strength and lasting qualities. Gravel has the advantage, however, of giving a lower material consumption per unit volume, as gravel generally has fewer voids than crushed stone, usually 20 per cent less.—Anon. (*Statens Provningsanstalt*, Sweden, 40, and Hi. *Zement*, July 4, 1929).

Herzog Lime & Stone Company Uses Trucks

DRIVING ALONG well paved highways viewing the springing up of beautiful homes and giant skyscrapers there are but few who look back through the lanes of this progress to the stone quarry where daily men wrestle with nature to supply the material for these needed improvements.

Far below the surface of the earth giant rock is being blasted, steam and electric shovels are trudging here and there digging out the stone, the lime and the other products needed for construction in an ever progressing world.

Here we find manifold problems with transportation being one of the most important. Rock must be carried to the crusher under the most severe conditions, through water, around sharp curves and up steep grades.

In the past, steam, gas or electric locomotives, with railway dump cars as carriers, was the accepted equipment for carrying rock from the pit to the primary crusher. Today, due to the apparent greater flexibility and increased production at a lower cost, trucks are going into the quarries.

In many instances trucks have cut down the time from the shovel to the crusher; have done away with the maintenance of tracks and crews and are proving their dependability in quarry hauling. In quarry operations, where railroads are used, that portion of the trackage lying some distance away from the loading and blasting is usually a permanent installation. But most of the trackage is constantly shifted as new parts of the pit are blasted and prepared for working.

Truck receiving a load at the screening plant after hauling a load of stone from the pit to the crusher

The advantages claimed for truck operation in quarries are to be summed up as follows: Lower cost of transportation; lower operating cost of equipment; lower capital investment; and less labor cost. Increased production through elimination of delays while track is being shifted; uninterrupted delivery of stone to crusher; increased output of shovel; elimination of time required for breaking train, hooking and unhooking and recoupling of cars.

Where the primary crusher is confined to the bottom of the pit, trucks of either end or side dump can be used, keeping up a continuous flow of stone to the crusher. Where the crusher is on an upper level the truck is again at an advantage with its special low gears, which makes it possible to negotiate the severest of grades.

In the modern plant of the Herzog Lime Stone Company, of Forest Ohio, truck operation is now being used entirely. The plant, which was described in the March 27, 1929, issue of PIT AND QUARRY, is located at McVitty, Ohio, three miles south of Forest, and its products are kiln limestone, dolomite flux, commercial sizes and agricultural screenings.

All rock is transported from the quarry face to the primary crusher with six heavy-duty Whites, three Model 52 and three Model 45, the latter having been purchased as used trucks and placed in operation more than a year ago. These trucks average 5 tons per trip, negotiating a 15 per cent grade to the primary crusher over a distance of approximately 1,200 feet. Three

This truck has no difficulty in getting under the arm from any angle

Model 52, negotiating a 15 per cent grade

hundred tons can be delivered to the crusher per hour.

The Model 52 is equipped with the White auxiliary transmission, which provides a fifth speed or low gear for negotiating the severe grades. The trucks carry mechanical hoists and end dump bodies. These bodies are built with double I beams the entire length, the floor being covered with two-inch oak and this flooring covered with a steel wear plate. Bodies are built without end gate, but the floor is two feet longer than the top, giving the appearance of a body end gate in lowered position and facilitating dumping into the crusher.

The company will soon install a larger crusher capable of handling 600 tons of stone per hour, built so trucks can dump into it from both sides.

Conditions in quarries vary to a considerable extent and require different methods of truck operation and equipment. End dump bodies with hydraulic or mechanical hoists are preferred, as there is a saving of from 2,000 to 4,000 pounds in body weight over the type of side dump body which must be used for quarry service.

Recent Patents

The following patents of interest to readers of PIT AND QUARRY recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20c each. State number of patent and name of inventor when ordering.

1,717,759. Hammer for rotary crushers. William C. Briggs, Elkins Park, Pennsylvania.

1,717,876. Machine for conveying and stowing loose materials. Kenneth Davis, St. Benedict, Pennsylvania.

1,717,894. Crusher. Harvey H. Rumpel, Milwaukee, Wisconsin, assignor to Smith Engineering Works, same place.

1,717,902. Rotary plate-like screen. Otto Wiencke, Leipsic, Germany.

1,717,907. Dipper front. Oscar W. Anderson, Oak Park, Illinois, assignor to Pettibone Mulliken Company.

1,718,050. Roll-crusher teeth. George E. Krider, Hollidaysburg, Pennsylvania, assignor to McLanahan-Stone Machine Company, same place.

1,718,184. Comminuting solid substances. Walter Ostermann, Barmen-Langerfeld, Germany, assignor to Industrial Spray Drying Corporation, New York, New York.

1,718,268. Reversible-point excavating tooth. Adolf F. Wikstrom, Chicago Heights, Illinois, assignor to American Manganese Steel Company, Chicago, Illinois.

1,718,385. Screen. Charles F. Sherwood, Mill Valley, California, assignor to Oliver-Sherwood Company, San Francisco, California.

1,718,386. Rubber-covered woven screen. Charles F. Sherwood, Mill Valley, California, assignor to Oliver-Sherwood Company, San Francisco, California.

1,718,434. Counterbalance for ditching-machines. Charles T. Konk, Cedar Rapids, Iowa.

1,718,552. Rotary grinding-mill. William H. Fluker, Thomson, Georgia.

1,718,941. Jigging conveyor. Gustav Bockau, Ottumwa, Iowa, assignor to Ottumwa Iron Works, same place.

1,718,955. Lime-hardening composition and process of making it. Douglas M. Harrison, East St. Louis, Illinois, assignor to McKenzie Mortar Company, Pittsburgh, Pennsylvania.

1,719,122. Impeller for vibrators. Benjamin A. Mitchell, Tompkinsville, New York.

1,719,123. Impeller for vibrators, crushers, etc. Benjamin A. Mitchell, Tompkinsville, N. Y.

1,719,164. Ball mill. Richard Bernhard, Allentown, Pennsylvania, assignor to Traylor Engineering Company, same place.

1,719,219. Bucket-cleaner for trenching machines. Charles L. George, Findlay, Ohio, assignor to Buckeye Traction Ditcher Company, same place.

1,719,259. Automatic sand-drying equipment. Frank D. Chadwick, Ottawa, Illinois.

1,719,328. Bucket-unloading device for excavators. George H. Grennan, Garner, Iowa.

1,719,332. Apparatus for washing sand and other material. Joseph E. Kennedy, New York, New York.

1,719,333. Jaw crusher. Joseph E. Kennedy, New York, New York.

1,719,496. Sand-elevator. Elmer O. Beardsley and Walter F. Piper, Chicago, Illinois, assignors to Beardsley & Piper Company, same place.

1,719,513. Coal-screen. Frederick A. Krehbiel, Hinsdale, Illinois.

1,719,549. Crushing or pulverizing machine. Walter R. Hume, Melbourne, Australia.

1,719,576. Mining bucket. Grover C. Voit, Hopedale, Ohio.

1,719,598. Overhead cableway system. Joseph H. Dickinson, Winter Park, Florida, assignor to Lidgerwood Manufacturing Company, New York. New York.

1,719,775. Tooth for excavating dippers and the like. Walter E. Miley. Marion, Ohio, assignor to Marion Steam Shovel Company, same place.

1,719,831. Two-zone pulverizing apparatus. Fred H. Daniels, Worcester, Massachusetts, assignor to Riley Stoker Corporation, same place.

1,719,979. Crushing machine for hard materials. Johannes Ihlefeldt, Dessau, Germany.

1,720,024. Ore mill and grinding element therefor. Donald H. Young, Berkeley, California, assignor to American Manganese Steel Company, Chicago, Illinois.

1,720,026. Method of slaking lime and producing hydrate of lime. William H. Barton, Los Angeles, California, assignor to Blue Diamond Company, same place.

1,720,048. Safety-hoist mechanism for loading skips. Erich H. Litchenberg, Milwaukee, Wisconsin, assignor to Koehring Company, same place.

1,720,195. Excavating device. Oliver O. App, New York, New York, assignor to App Tunneling Machine Company.

1,720,197. Free-way valve for concrete-mixing machines. Charles F. Ball, Milwaukee, Wisconsin, assignor to Chain Belt Company, same place.

1,720,364. Explosion-proof mining apparatus. Morris P. Holmes. Claremont, New Hampshire, assignor to Jeffrey Manufacturing Company, Columbus, Ohio.

1,720,626. Earth, sand, gravel, and manure loader. Harvey B. Church, Botha, Alberta, Canada.

Portland Cement Production For June

The ratio of the operations to the capacity of the American portland cement industry during the month of June was 80.9 per cent, according to figures released by the Bureau of Mines of the Department of Commerce. During the month 16,775,000 barrels were produced, 18,939,000 barrels were shipped and there were in stocks on hand at the end of the month 27,433,000 barrels.

Annual Report of Portland Cement Production, Distribution, Export and Import

Portland cement produced, shipped and in stock in the United States, 1927 and 1928, by States

State	Production					Shipments							Stock (Dec. 31)		
	Active plants		Barrels		Increase or decrease 1928 (per cent)	1927		1928		Average factory value per barrel		Increase or decrease in quantity 1928 (per cent)	Barrels		Increase or decrease 1928 (per cent)
	1927	1928	1927	1928		Barrels	Value	Barrels	Value	1927	1928		1927 (revised)	1928	
Ala.	6	6	7,564,863	6,749,202	−11	7,313,494	$10,615,428	6,696,684	$ 8,233,872	$1.45	$1.23	− 8	655,024	707,542	+ 8
Calif.	12	12	14,580,654	13,452,221	− 8	14,433,153	26,623,396	13,596,493	25,552,069	1.84	1.88	− 6	840,506	696,234	−17
Ill.	4	4	7,017,047	7,334,833	+ 5	7,061,240	11,312,783	7,405,667	11,602,848	1.60	1.57	+ 5	768,275	697,441	− 9
Iowa	5	6	5,415,144	7,070,172	+31	5,661,234	9,124,405	6,880,731	10,734,838	1.61	1.56	+22	1,370,481	1,559,922	+14
Kans.	7	7	6,180,255	6,574,219	+ 6	6,141,937	9,939,412	6,787,568	10,091,330	1.62	1.49	+11	1,137,286	923,937	−19
Mich.	15	14	13,965,241	13,848,561	− 8	13,708,259	20,858,202	14,044,230	19,628,495	1.52	1.40	+ 3	2,206,202	2,010,533	− 9
Mo.	5	5	6,778,384	7,881,118	+16	6,929,229	11,117,047	7,943,367	12,367,018	1.60	1.56	+15	957,053	894,804	− 7
Ohio	10	10	8,853,869	9,233,033	+ 4	8,727,879	14,242,901	9,364,338	14,928,183	1.63	1.59	+ 7	1,205,379	1,074,074	−11
Pa.	25	26	43,732,278	41,522,401	− 5	42,909,513	66,711,069	41,161,019	62,572,588	1.55	1.52	− 4	5,868,169	6,229,551	+ 6
Tenn.	5	6	4,430,439	4,689,703	+ 6	4,343,337	6,580,732	4,634,280	6,322,213	1.52	1.36	+ 7	515,245	570,668	+11
Texas	7	7	5,655,835	6,345,604	+12	5,692,350	10,232,908	6,231,083	10,938,646	1.80	1.76	+10	407,403	521,924	+28
Other States[1]	52	53	49,032,504	51,494,421	+ 5	48,943,103	81,496,364	50,989,514	82,913,802	1.67	1.63	+ 4	6,526,359	7,031,266	+ 8
	153	156	173,206,513	176,195,488	+ 2	171,864,728	278,854,647	175,734,974	275,885,902	1.62	1.57	+ 2	22,457,382	22,917,896	+ 2

[1]Includes Colorado, Florida, Georgia, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, New York, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia and Wisconsin.

Shipments of domestic Portland cement from mills into States and per capita, 1927 and 1928, in barrels [1]

State	1927		1928	
	Total	Per capita[1]	Total	Per capita[1]
Alabama	2,264,576	0.89	2,946,905	1.15
Arizona[2]	562,460	1.23	692,729	1.46
Arkansas[2]	855,051	.44	1,251,341	.64
California	13,128,911	2.96	12,356,292	2.71
Colorado	1,002,396	.93	1,064,302	.98
Connecticut[2]	2,061,892	1.26	2,283,726	1.37
Delaware[2]	342,905	1.41	348,719	1.43
District of Columbia[2]	981,732	1.82	889,541	1.61
Florida	2,482,725	1.82	1,325,201	.94
Georgia	1,904,685	.60	1,742,266	.54
Idaho[2]	311,226	.58	294,925	.54
Illinois	14,832,550	2.03	17,676,964	2.39
Indiana	5,738,557	1.82	5,274,423	1.66
Iowa	3,708,471	1.53	5,348,807	2.20
Kansas	2,432,055	1.33	2,341,459	1.28
Kentucky	1,953,629	.77	1,739,053	.68
Louisiana	1,490,560	.77	1,274,387	.65
Maine[3]	505,952	.64	522,573	.66
Maryland	2,651,700	1.66	2,242,316	1.39
Massachusetts[2]	2,820,132	.66	2,915,928	.68
Michigan	11,576,188	2.58	11,775,822	2.56
Minnesota	3,380,002	1.26	3,054,582	1.12
Mississippi[2]	980,791	.55	1,128,613	.63
Missouri	4,207,151	1.20	4,717,741	1.34
Montana	307,968	.43	461,299	.84
Nebraska	1,360,032	.97	1,195,650	.85
Nevada[2]	87,276	1.13	106,321	1.37
New Hampshire[2]	459,706	1.01	515,317	1.13
New Jersey	8,419,323	2.25	8,436,886	2.21
New Mexico[2]	278,528	.71	333,250	.84
New York	23,002,585	2.01	22,320,713	1.93
North Carolina[2]	3,213,314	1.11	2,400,601	.82
North Dakota[2]	392,730	.61	454,873	.71
Ohio	10,342,424	1.54	11,013,338	1.61
Oklahoma	3,119,565	1.31	3,125,602	1.29
Oregon	1,399,167	1.57	1,255,925	1.39
Pennsylvania	13,837,359	1.42	12,996,494	1.32
Rhode Island[2]	700,851	1.00	760,813	1.06
South Carolina[2]	985,874	.53	1,508,279	.81
South Dakota	409,820	.59	491,102	.70
Tennessee	2,262,697	.91	2,697,996	1.08
Texas	5,437,907	1.01	6,193,925	1.13
Utah	428,469	.82	507,666	.96
Vermont[2]	393,294	1.12	605,930	1.72
Virginia	1,799,062	.71	1,993,581	.77
Washington	2,574,293	1.65	2,972,167	1.87
West Virginia	1,561,978	.92	1,360,192	.79
Wisconsin	5,553,176	1.90	5,380,070	1.82
Wyoming[2]	181,103	.75	197,144	.80
Unspecified	51,818	.....	83,869	.....
	170,736,616	1.44	174,577,618	1.45
Exports reported by manufacturers but not included above[4]	1,128,112	.....	1,157,356	.....
Total shipped from cement plants	171,864,728	.....	175,734,974	.....

[1]Per capita figures based on estimate of population made by the Bureau of the Census.
[2]Noncement-producing State.
[3]Maine began producing April, shipping May, 1928.
[4]Includes shipments to Alaska, Hawaii, and Porto Rico.

Output of Portland Cement in 1928

Statistics relating to the portland cement industry in 1928 compiled by the United States Bureau of Mines, Department of Commerce, from the final returns of the producers for the year, which are, however, still subject to revision, confirm the estimates published by the Bureau of Mines early in January.

Production of portland cement in 1928—176,195,488 barrels—was the largest quantity manufactured thus far in any year, exceeding that in 1927, the next highest year in production, by 2 per cent.

Shipments of portland cement from mills in 1928 amounted to 175,734,974 barrels, valued at $275,885,902, an increase of 2 per cent in quantity and a decrease of 1.1 per cent in gross value. The average factory price per barrel in bulk in 1928 was $1.57, a decrease of 5 cents per barrel as compared with 1927.

Stocks at the mills also increased, reaching a total of 22,917,896 barrels on December 31, 1928, the greatest at the end of any year during which official records of stocks have been kept. They were about 2 per cent higher than at the end of 1927.

From the reports of the producers showing mill shipments of portland cement into the various states estimates of per capita consumption in the accompanying table have been compiled. These are at best but approximations as they represent only the records of mill shipments into

states; they do not include the imports, which would increase the consumption in certain states near the Canadian border and the seaboard, nor do they make allowance for a variable but considerable stock of cement at all times in transit, in warehouses at distributing points, and awaiting use at jobs.

The commercial capacity for production of finished portland cement of the 156 plants active at the end of 1928, and of three plants idle in 1928 but producing within the two previous years, according to manufacturers' reports supplemented by a few estimates, was 243,252,000 barrels. This total includes besides increased capacity due to extensions and improvements at old plants approximately 3,900,000 barrels capacity for finished portland cement of 4 new plants that began operating during the year and are located one each in Maine, Pennsylvania, Tennessee, and Washington. The total production for the year 1928 was 72.4 per cent of the indicated capacity at the close of the year. The corresponding figure for 1927 from the producers' reports was 76.3 per cent.

A summary of the monthly estimates of output of portland cement in 1928, compiled from the monthly reports of producers, was published early in January, 1929, by the Bureau of Mines. These estimates, which indicated a production of 175,968,000 barrels and shipments of about 175,455,000 barrels, were within 0.1 per cent and 0.2 per cent, respectively, of the figures for 1928 here presented

Mining and Milling Asbestos

Mining methods in the asbestos industry vary according to the geological occurrence of the asbestos, says the United States Bureau of Mines, Department of Commerce, in a report recently issued. The asbestos in limestone, such as the deposits in Arizona, is usually mined by tunnels and lateral drifts, or by some simple system of underground mining following the ore. In the Arizona field the ore is first blocked out and then stoped, the roof, after stoping, being upheld by the waste rock. In this field, it is common practice to keep the roof close to the asbestos zone and to pick down the ore on to a large canvas after the supporting rock has been removed.

Asbestos in peridotite or large masses of serpentine is generally mined by open pit, as in Canada. After the rock is blasted, it is sorted and cobbed, all fiber ¾ inch long and over being bagged as Crude No. 1, corresponding fiber ⅜ to ¾ inch in length being bagged as Crude No. 2. The

Import and Exports*

Imports of hydraulic cement by countries and by districts in 1928

Imported from	District into which imported	Barrels	Value
Belgium	Florida	72,806	$91,548
	Galveston	93,637	121,906
	Hawaii	37,444	47,438
	Los Angeles	6,100	7,326
	Maine and New Hampshire	15,000	20,313
	Massachusetts	470,090	660,497
	New Orleans	15,584	20,246
	New York	114,581	147,369
	North Carolina	177,160	238,586
	Ohio	1	4
	Oregon	67,567	84,044
	Philadelphia	138,692	200,366
	Porto Rico	705	1,260
	Rhode Island	54,036	71,016
	Sabine	6,420	13,564
	San Antonio	15,000	17,700
	South Carolina	383,055	480,904
	Virginia	1,200	1,328
	Washington	57,479	78,220
	Total	1,726,557	2,303,635
Canada	Maine and New Hampshire	35,335	78,549
	St. Lawrence	1,510	2,894
	San Francisco	2	6
	Vermont	974	1,378
	Total	37,821	82,827
Denmark	New York	36,326	38,000
	Oregon	3,000	3,205
	Porto Rico	299,398	401,301
	Total	338,724	442,506
France	Los Angeles	2	15
	New York	10,261	25,983
	Oregon	13	30
	Total	10,276	26,028
Germany	Los Angeles	8,786	20,814
	Massachusetts	250	417
	New York	234	342
	Philadelphia	6	39
	Total	9,276	21,612
Hungary	Philadelphia	10	31
Irish Free State	New York	3	34
Italy	New York	5	14
Norway	Philadelphia	7,069	8,006
	Porto Rico	24,183	30,393
	San Francisco	75	76
	South Carolina	30,000	35,180
	Total	61,327	73,655
Poland and Danzig	Maryland	4,166	3,555
Sweden	New York	1	8
United Kingdom	Galveston	12,000	15,785
	Los Angeles	300	625
	New York	61,422	90,509
	Ohio	1	8
	Oregon	148	304
	Philadelphia	21,745	29,081
	San Francisco	303	643
	Total	95,919	136,955
	Grand total	2,284,085	3,090,860

*Compiled from records of the Bureau of Foreign and Domestic Commerce and subject to revision.

Exports of hydraulic cement by countries in 1927 and 1928

Exported to	1927		1928	
	Barrels	Value	Barrels	Value
Canada	24,103	$ 112,741	39,927	$ 202,628
Central America	120,179	356,911	125,718	370,219
Cuba	107,020	279,957	99,907	256,201
Other West Indies and Bermuda	68,637	162,225	57,382	145,759
Mexico	78,516	254,214	77,676	250,371
South America	352,892	1,250,258	342,546	1,240,132
Other countries	65,379	380,411	81,500	473,392
	816,726	2,796,717	824,656	2,938,702

Domestic hydraulic cement shipped to Alaska, Hawaii, and Porto Rico in 1927-28

	1927		1928	
	Barrels	Value	Barrels	Value
Alaska	19,517	$ 59,815	13,838	$ 41,430
Hawaii	296,639	710,730	291,305	681,468
Porto Rico	103,741	256,179	46,700	114,409
	419,897	1,026,724	351,843	837,307

Compiled from records of the Bureau of Foreign and Domestic Commerce and subject to revision.

mill fiber, or fiber shorter than ⅜ inch, is separated from the crushed rock by pneumatic and screening processes.

Crude fiber is usually graded by hand-cobbing and sorting, though sometimes the poorer material is screened. The very short fiber that forms the great bulk of the world's production is separated by milling. Mill fiber is graded largely on the basis of screen tests. Screens of 2, 4, and 10 meshes to the inch are used. Sixteen ounces of fiber are taken, and the amounts retained on each screen and that which passes through the last one is recorded after the screens have been shaken in a specified manner for two minutes. Thus 1-8-5-2 would indicate that 1 ounce remained on the 2-mesh screen, 8 ounces on the 4-mesh, and 5 ounces on the 10-mesh, and that 2 ounces passed through the 10-mesh screen.

The volume of waste in the asbestos industry is enormous, for much of the rock broken must be discarded. In the Canadian field, the largest in the world, the average yield per ton of rock mined is 1 per cent of crude asbestos and a fraction over 6 per cent of mill fiber.

The waste product of milling is known as asbestic, or asbestos sand. It consists of serpentine, unaltered peridotite, and a small quantity of very short fiber, and is used principally as an ingredient in plaster and stucco. Practically all the rock that goes through the mill is eventually asbestic.

Imports of hydraulic cement in 1927 and 1928, by districts

District	1927		1928	
	Barrels	Value	Barrels	Value
Alaska	5	$ 25	.....	.....
Florida	308,682	420,286	72,806	$ 91,548
Galveston	18,328	24,908	105,637	137,691
Georgia	20,000	30,080	.....	.....
Hawaii	37,326	61,356	37,444	47,438
Los Angeles	11,278	18,770	15,188	28,780
Maine and New Hampshire	42,602	72,179	50,335	98,862
Maryland	500	809	4,166	3,555
Massachusetts	481,541	649,686	470,340	660,914
New Orleans	55,031	80,925	15,584	20,246
New York	39,423	67,317	222,833	302,259
North Carolina	.....	.....	177,260	238,586
Ohio	.....	.....	2	12
Oregon	31,620	43,269	70,728	87,583
Philadelphia	305,920	425,485	167,522	237,523
Porto Rico	319,653	511,399	324,186	432,954
Rhode Island	80,156	108,627	54,036	71,016
Sabine	8,000	15,500	6,420	13,564
Saint Lawrence	16,242	38,632	1,510	2,894
San Antonio	.....	.....	15,000	17,700
San Francisco	38,007	50,431	380	725
South Carolina	196,571	279,801	413,055	516,084
Vermont	1,518	2,293	974	1,378
Virginia	5,974	9,666	1,200	1,328
Washington	31,803	45,007	57,479	78,220
	2,050,180	2,956,451	2,284,085	3,090,960

In addition to the imports shown in the preceding tables there are also reported "imported for consumption, white nonstaining portland cement": in 1927, 15,800 barrels, valued at $50,657; in 1928, 16,308 barrels, valued at $44,445.

Portland cement manufacturing capacity of the United States, by commercial districts, 1928

District	Estimated capacity (barrels)	Percentage of capacity utilized
Eastern Pennsylvania, New Jersey, and Maryland	50,945,000	77.9
New York and Maine [1]	17,037,000	67.4
Ohio, Western Pennsylvania, and West Virginia	24,671,000	74.3
Michigan	19,508,000	71.0
Wisconsin, Illinois, Indiana and Kentucky	26,607,000	85.5
Virginia, Tennessee, Alabama, Georgia, Florida and Louisiana	24,667,000	64.7
Eastern Missouri, Iowa, Minnesota and South Dakota	22,993,000	72.6
Western Missouri, Nebraska, Kansas and Oklahoma	14,598,000	74.9
Texas	7,700,000	82.4
Colorado, Montana and Utah	5,567,000	49.8
California	22,700,000	59.3
Oregon and Washington	6,259,000	63.3
	243,252,000	72.4

[1] Maine began producing in April, 1928.

Portland cement produced, shipped and in stock in the United States, 1927 and 1928, by districts

District	Production					Shipments							Stock (Dec. 31)		
	Active plants		Barrels		Increase or decrease 1928 (per cent)	1927		1928		Average factory value per barrel		Increase or decrease in quantity 1928 (per cent)	Barrels		Increase or decrease 1928 (per cent)
	1927	1928	1927	1928		Barrels	Value	Barrels	Value	1927	1928		1927 (revised)	1928	
East. Pa., N. J. and Md.	24	25	42,687,200	39,677,010	− 7	41,656,489	$64,614,336	39,738,910	$60,236,388	$1.55	$1.52	− 5	5,471,989	5,410,089	− 1
New York and Maine[1]	11	12	10,775,375	11,484,054	+ 7	10,531,092	16,380,090	11,357,052	17,386,416	1.56	1.53	+ 8	1,528,718	1,655,720	+ 8
Ohio, Western Pa. and W. Va.	18	18	17,339,199	18,326,478	+ 6	17,202,341	27,638,726	18,037,131	28,375,472	1.61	1.57	+ 5	2,571,795	2,861,142	+11
Mich.	15	14	13,965,241	13,848,561	− 8	13,708,259	20,858,202	14,044,230	19,628,495	1.52	1.40	+ 3	2,206,202	2,010,533	− 9
Wis., Ill., Ind. and Ky.	11	11	22,022,150	22,748,604	+ 3	22,394,739	36,274,654	22,627,309	35,575,358	1.62	1.57	+ 1	2,614,241	2,735,536	+ 5
Va., Tenn., Ala., Ga., Fla. and La.	18	19	16,016,154	15,949,537	− 4	15,530,338	23,668,315	15,770,338	21,253,288	1.52	1.35	+ 2	1,680,032	1,859,231	+11
Eastern Mo., Ia., Minn., So. Dak.	11	12	14,358,201	16,692,696	+16	14,566,818	23,325,158	16,544,026	25,777,858	1.60	1.56	+ 14	2,731,067	2,879,737	+ 5
Western Mo., Nebr., Kans. and Okla.	11	11	10,092,888	10,938,637	+ 8	10,250,532	16,809,793	11,221,802	17,444,193	1.64	1.55	+10	1,629,230	1,346,065	−17
Texas	7	7	5,655,835	6,345,604	+12	5,692,350	10,232,908	6,231,083	10,938,646	1.80	1.76	+10	407,403	521,924	+28
Colo., Mont. and Utah	8	7	2,179,241	2,771,863	+27	2,293,514	4,692,136	2,628,003	5,696,187	2.05	2.17	+15	380,450	524,310	+38
Calif.	12	12	14,580,654	13,452,221	− 8	14,433,153	26,623,396	13,596,493	25,552,069	1.84	1.88	− 6	840,506	696,234	−17
Oreg. and Wash.	7	8	3,534,375	3,960,223	+12	3,605,103	7,736,933	3,938,597	8,021,532	2.15	2.04	+ 9	395,749	417,375	+ 6
	153	156	173,206,513	176,195,488	+ 2	171,864,728	278,854,647	175,734,974	275,885,902	1.62	1.57	+ 2	22,457,382	22,917,896	+ 2

[1] Maine began producing in April, 1928.

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the States to which cement was shipped during April and May, 1928 and 1929.

Portland cement shipped from mills into States in April and May, 1928 and 1929, in barrels.

Shipped to—	April		May	
	1928	1929	1928	1929
Alabama	233,865	166,925	294,946	172,774
Alaska	542	1,778	588	1,641
Arizona	64,808	51,150	23,982	57,318
Arkansas	86,513	99,392	120,605	98,352
California	1,058,739	973,052	1,101,338	977,113
Colorado	90,312	99,991	122,205	106,514
Connecticut	187,697	158,919	273,367	202,088
Delaware	26,177	31,219	35,361	35,101
District of Columbia	66,108	97,218	66,508	109,630
Florida	134,647	101,227	90,435	105,070
Georgia	155,787	139,353	167,422	121,574
Hawaii	19,314	24,308	29,807	32,262
Idaho	30,832	26,923	35,009	35,183
Illinois	1,192,251	1,069,018	2,087,924	1,582,822
Indiana	355,434	365,104	568,668	473,247
Iowa	405,654	215,629	929,356	579,284
Kansas	202,705	285,944	250,076	258,469
Kentucky	130,168	163,059	178,020	146,312
Louisiana	112,667	105,290	110,257	119,105
Maine	30,015	34,197	49,458	56,862
Maryland	176,807	169,575	250,926	235,749
Massachusetts	256,150	225,829	306,685	302,554
Michigan	710,731	785,443	1,218,783	1,192,636
Minnesota	185,901	220,077	446,443	349,030
Mississippi	73,651	76,425	89,421	79,602
Missouri	383,704	405,208	473,066	436,278
Montana	32,676	49,313	50,054	76,910
Nebraska	108,224	106,392	131,720	140,069
Nevada	7,195	10,848	11,050	16,672
New Hampshire	34,667	42,936	48,034	68,743
New Jersey	778,746	689,358	899,439	890,817
New Mexico	27,664	33,100	30,612	28,898
New York	1,758,888	1,597,182	2,414,892	2,125,854
North Carolina	199,340	224,791	259,658	222,589
North Dakota	34,627	62,207	69,986	58,458
Ohio	776,992	849,359	1,263,450	988,751
Oklahoma	209,850	309,739	307,249	270,695
Oregon	102,480	79,593	143,000	94,250
Pennsylvania	928,060	959,640	1,396,046	1,295,845
Porto Rico	0	975	500	300
Rhode Island	81,029	65,457	93,304	81,003
South Carolina	101,838	131,517	141,083	139,583
South Dakota	42,599	40,519	65,137	54,128
Tennessee	216,928	231,259	274,229	247,767
Texas	526,063	694,150	601,278	622,387
Utah	36,932	46,663	38,520	67,602
Vermont	27,791	33,851	43,912	83,933
Virginia	175,192	176,266	201,315	190,844
Washington	237,749	255,250	315,209	208,793
West Virginia	103,682	93,098	151,015	115,608
Wisconsin	287,693	352,986	615,376	633,041
Wyoming	15,229	12,491	18,033	20,364
Unspecified	41,738	23,846	27,702	13,263
	13,265,051	13,265,039	18,932,459	16,623,737
Foreign Countries	41,949	59,961	53,541	82,263
Total shipped from cement plants	13,307,000	13,325,000	18,986,000	16,706,000

Relation of Production to Capacity

	June		May	April	March
	1928	1929	1929	1929	1929
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
The month	90.1	80.9	76.4	67.1	47.4
The 12 months ended	73.8	69.0	70.2	71.1	70.9

Production, shipments, and stocks of finished Portland cement, by districts, in June, 1928 and 1929, and stocks in May, 1929 (In thousands of barrels)

District	June						Stocks at end of May
	Production		Shipments		Stocks at end of month		
	1928	1929	1928	1929	1928	1929	1929
Eastern Pa., N. J., & Md.	4,065	3,697	4,081	4,201	6,131	5,852	6,355
New York and Maine	1,208	1,197	1,264	1,383	1,843	2,009	2,195
Ohio, Western Pa., & W. Va.	1,720	1,885	1,759	2,046	3,434	3,550	3,711
Michigan	1,456	1,466	1,731	1,720	1,955	2,470	2,724
Wis., Ill., Ind., & Ky.	2,446	2,305	2,443	2,707	3,004	3,650	4,052
Va., Tenn., Ala., Ga., Fla., & La.	1,391	1,251	1,409	1,278	1,872	2,063	2,090
Eastern Mo., Ia., Minn. & S. Dak.	1,715	1,607	2,109	2,123	3,131	3,745	4,261
Western Mo., Neb., Kans. & Okla.	1,055	1,089	1,058	1,126	1,570	1,490	1,527
Texas	540	554	573	579	356	510	535
Colo., Mont., Utah, Wyo. & Idaho	275	325	299	336	486	509	521
California	1,206	1,110	1,255	1,113	820	995	997
Oreg. & Wash.	420	289	440	327	427	590	629
	17,497	16,755	18,421	18,939	25,029	27,433	29,597

Production and stocks of clinker, by months, in 1928 and 1929. (In thousands of barrels)

Month	Production		Stock end of month		Month	Production		Stock end of month	
	1928	1929	1928	1929		1928	1929	1928	1929
January	11,339	12,041	9,672	9,642	July	15,981	.....	11,707	.....
February	11,363	11,255	12,237	12,436	August	16,202	.....	9,357	.....
March	12,501	12,450	14,463	14,948	September	15,909	.....	7,566	.....
April	13,844	14,166	15,002	15,472	October	15,782	.....	5,944	.....
May	16,025	15,445	14,329	14,910	November	14,930	.....	5,953	.....
June	15,940	15,283	12,944	13,573	December	13,426	.....	7,422	.....

Cement Statistics for June, 1929

The portland cement industry in June, 1929, produced 16,775,000 barrels, shipped 18,939,000 barrels from the mills, and had in stock at the end of the month 27,433,000 barrels, according to the United States Bureau of Mines, Department of Commerce. The production of portland cement in June, 1929, showed a decrease of 4.1 per cent and shipments an increase of 2.8 per cent, as compared with June, 1928. Portland cement stocks at the mills were 9.6 per cent higher than a year ago. The total production for the first half of 1929 amounts to 75,048,000 barrels, compared with 77,061,000 barrels in the same period of 1928, and the total shipments for the first half of 1929 amount to 70,238,000 barrels, compared with 73,953,000 barrels in the same period of 1928.

The output of two more new plants, located respectively in Idaho and Texas, is included in the statistics here presented which are compiled from reports for June, from all manufacturing plants except two for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 163 plants at the close of June, 1929, and of 158 plants at the close of June, 1928. In addition to the capacity of the new plants which began operating during the twelve months ended June 30, 1929, the estimates include increased capacity due to extensions and improvements at old plants during the period.

New Corporations

Cimenteries et Briqueteries Reunies, Antwerp, Belgium. $64,000,000.

Societe des Ciments Libanais, Tripoli, Liban, Africa. $3,600,000.

Oatsman Sand & Gravel Co., Flint, Mich. $50,000.

Bosardville Limestone Co., Bethlehem, Pa. $25,000. W. Arthur Schneller, Chas. F. Schwartz, John H. Diefenderfer.

Colorado County Gravel Co., Inc., Columbus, Tex. $100,000. J. A. Harbert, S. Hamburger, J. C. Burt.

Commonwealth Sand Co., Paul P. Bird, Treas., 88 Broad St., Boston, Mass.

Port Crescent Sand & Fuel Co., Madison, Wis. $200,000. W. I. Sallee, Milwaukee, Wis.

Marine Sand & Gravel Co., 56 W. Illinois St., Chicago. 100 shares n.p.v. B. L. Hoskins, Pres.; L. J. Rech, V. P.; Thos. H. Murray, Secy. Dredging op-

erations in Lake Michigan; docks at ft. of Austin Ave., Chicago.

Cumberland Gap Stone & Pipe Co., Inc., Gibson Station, Va. $15,000. Mrs. Fanny Price, Harrogate, Tenn. Crushed stone.

Consolidated Graphite Corp., c/o Corp. Trust Co. of Amer., Wilmington, Del. 106,000 shares com.

Eugene W. Smith, Inc., Evansville, Ind. Eugene W. Smith, Sr.; Eugene W. Smith, Jr. To produce moulding sand.

Travertine Rock Co., J. G. Dee, 411 Villagrande St., St. Petersburg, Fla.

Illinois Lime & Cement Co., c/o D. H. Mann, of Gallagher, Kohlsaat, Rinaker & Wilkinson, attorneys, 231 S. LaSalle St., Chicago. $1,300,000. E. C. Kohlsaat, D. H. Mann, F. H. Cowley.

Phoenix Sand & Gravel Co., Jefferson City, Mo. 500 shares n.p.v. Burrell McInerney, Dallas, Tex.; P. J. McInerney, Dallas, Tex.; Jess Perkins, Bagnell, Mo.

Greater St. Louis Quarry & Construction Co., Valley Park, Mo. $12,000. Walter A. Droege, 5607 Columbia, St. Louis, Mo.; Sam J. Bryant, 8830 Made, Webster Groves, Mo.; Bernard J. Brown, Valley Park, Mo.

Investment of $400,000,000 Sand and Gravel Industry

As a means of visualizing the extent of development and building work in progress in the United States, it is estimated, on the basis of figures compiled by the Department of Commerce, that the amount of sand and gravel consumed in one year in this country would load a train more than 45,000 miles long, or approximately a quarter of the distance to the moon.

These figures demonstrate that what is popularly considered to be an incidental phase of the construction activities of the country is in itself a huge industry occupying an essential position in the nation's economic structure.

According to official figures, the aggregate (sand and gravel) industry has grown more than 432 per cent since 1908, and in 1927 did a national business totaling $115,529,000.

There are about 1663 aggregate companies in the United States, few of which produce more than 25,000 tons per year. Five per cent of the companies furnish 50 per cent of the tonnage. Of the large number of smaller companies, 50 per cent are said to contribute less than 4 per cent of the entire market production. The investment in the aggregate industry in the United States is estimated to be about $400,000,000.

Exports and Imports

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision

Exports of hydraulic cement by countries in May, 1929

Exported to—	Barrels	Value
Canada	6,420	$33,303
Central America	1,619	6,336
Cuba	15,451	36,715
Other West Indies	2,737	6,509
Mexico	8,138	24,848
South America	18,344	80,914
Other countries	5,246	30,741
	57,955	219,366

Imports of hydraulic cement by countries and by districts, in May, 1929

Imported from—	District into which imported	Barrels	Value
Belgium	Connecticut	1,500	$1,547
	Florida	6,000	6,876
	Massachusetts	49,595	62,104
	New Orleans	2,844	3,479
	New York	7,412	13,523
	Philadelphia	23,899	33,679
	Porto Rico	1,542	3,450
	Rhode Island	6,000	7,372
	San Antonio	3,820	3,759
	South Carolina	10,000	12,073
	Total	112,612	147,862
Canada	Maine and New Hampshire	570	1,315
Denmark	New York	11,144	13,974
	Porto Rico	56,775	73,299
	Total	67,919	87,273
France	New York	614	1,290
Germany	Los Angeles	1,500	3,373
Norway	Porto Rico	1,700	2,311
United Kingdom	New York	14,528	22,836
	Philadelphia	1,203	1,594
	Total	15,731	24,430
	Grand Total	200,646	267,854

Exports and imports of hydraulic cement, by months, in 1928 and 1929

	Exports				Imports			
	1928		1929		1928		1929	
Month	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	56,400	$204,875	78,639	$283,002	$236,771	$315,797	151,302	$177,976
February	62,828	221,620	58,886	225,590	164,408	217,525	118,930	123,123
March	74,983	265,719	69,079	235,164	235,930	330,074	131,909	112,788
April	61,676	205,882	64,145	218,316	249,458	324,371	89,668	114,281
May	70,173	236,005	57,955	219,366	190,509	256,872	200,646	267,854
June	59,536	201,313			266,537	359,637		
July	83,759	291,055			112,887	151,877		
August	88,736	302,866			259,975	358,471		
September	71,995	252,843			173,439	226,295		
October	62,137	246,010			152,210	226,909		
November	69,313	260,310			65,969	89,732		
December	63,120	250,204			175,992	233,300		
	824,656	2,938,702			2,284,085	3,090,860		

Domestic hydraulic cement shipped to Alaska, Hawaii, and Porto Rico, in May, 1929

	Barrels	Value
Alaska	2,814	$8,398
Hawaii	28,033	66,229
Porto Rico	539	2,284
	31,386	76,911

Production and stocks of clinker (unground cement), by districts, in June, 1928 and 1929. (In thousands of barrels)

	Production		Stocks at end of month	
District	1928	1929	1928	1929
Eastern Pa., N. J., & Md.	3,665	3,397	1,941	2,361
New York and Maine	1,152	1,045	995	1,249
Ohio, Western Pa., & W. Va.	1,727	1,683	1,938	1,623
Michigan	1,270	1,242	1,699	1,167
Wis., Ill., Ind., & Ky.	1,916	2,023	1,506	2,084
Va., Tenn., Ala., Ga., Fla., & La.	1,365	1,166	956	1,150
Eastern Mo., Ia., Minn., & S. Dak.	1,584	1,457	900	1,024
Western Mo., Neb., Kans., & Okla.	1,031	1,036	563	706
Texas	479	587	94	228
Colo., Mont., Utah, Wyo. & Idaho	256	319	402	528
California	1,137	1,052	1,373	878
Oreg. & Wash.	358	276	577	575
	15,940	15,283	12,944	13,573

FROM THE FINANCIAL ANGLE

Conducted by D. Morgan Smith

Analyses of Individual Companies

International Cement Corp. Earnings Statement

6 months ended June 30	1929	1928
Net after depreciation, federal tax, etc.		
March quarter	$1,017,619	$1,067,928
June quarter	1,149,789	1,128,529
Total	2,167,408	2,196,457
Earned per share	$3.50 (617,031 shares)	$3.14* (618,826 shares)

* After preferred dividends since eliminated.

This Company is a prominent producer of cement with plants throughout the United States east of the Rocky Mountains, as well as in Cuba, Argentina and Uruguay. In addition to cement selling under the trade name of "Lone Star" it also manufactures a new, quick hardening type called "Incor."

The International Cement Corporation operates thirteen plants with an annual capacity in excess of 20,000,000 barrels. The policy of expansion is shown by the acquisition of two companies last year, and by 200 per cent expansion of capacity in the past four years.

The rapid expansion of net income for this period of years was checked in the opening months of 1929. While earnings for the first half of this year equaled $3.50 per share, against $3.14 for like period a year earlier, the apparent gain, resulting from net income which was smaller in the latest period, was made possible by the redemption of the preferred stock in May 1928. The company earned $7.90 per share last year as compared with $6.90 per share in 1927, both on 618,826 shares outstanding with $4 per annum dividend requirements.

While sharp competition in eastern cement business may prevent a similiar expansion of earnings this year, nevertheless, sales are increasing, foreign subsidiaries are running at capacity and returning large profits, and the trade situation should be slightly improved before the end of the year by the enactment of tariff duty on foreign cement.

The concern is rather generous to stockholders through occasional issue of stock dividends and rights. Reflecting a recent failure to report earnings expansion, the price of the common has declined to around 80 from the year's high of 103. At this level we believe it is reasonably priced and while admitting that lower quotations may temporarily be witnessed, neverthless, this stock has a moderate attractiveness for holding over a period of a year or so.

Financial Department Established

PIT AND QUARRY, *always eager to be of service to its readers and to maintain its position as leader in the field has secured the services of D. Morgan Smith to conduct the financial department which is making its first appearance in this issue.*

Mr. Smith, whose home is in Erie, Pa., is a graduate of Kenyon College, Gambier, Ohio and until the early part of this year was connected with Folds, Buck and Company, a prominent investment house, whose main offices are in Chicago. He recently became attached to one of the oldest and most conservative brokerage and investment houses in the country, which maintains a large and most comprehensive statistical department.

Mr. Smith has gladly offered to answer, in these columns any financial questions. Replies to these inquiries will be treated in strict confidence and it is hoped that our readers will avail themselves of this service and will take an active interest in this new department.

United States Gypsum Co.

The United States Gypsum Co. was incorporated in 1901 in New Jersey as a consolidation of thirty five different producers of gypsum. The company which was changed from a New Jersey to an Illinois corporation in 1920 is the world's largest manufacturer of all classes of gypsum products, including hard plaster, cement plaster, prepared plaster, plaster board, gypsumite, stucco and bulk insulation. It also is doing a large business in relatively new gypsum lines including plastic paints, lime, metal lath, acoustic tile and plaster and stucco paints. The line has been increasingly diversified now consisting of over eighty products, and it has expended over twelve million dollars on new plants and improvements in the last eighteen months.

The principal properties of the company are located in Chicago, Ill., Oakfield, Akron, and Union Springs, New York, Cleveland, Genoa, and Gypsum, O., and also at various points in Michigan, Iowa, Wisconsin, Kansas, Oklahoma, Virginia, California, South Dakota, Nevada, Colorado, Texas and, Connecticut. Branch offices are maintained in nineteen cities in the United States.

Earnings in recent years are as follows:

	Net Income	Earned Per Share* Preferred	Common
1928	$6,032,000	$76.82	$7.22
1927	7,538,000	95.25	10.08
1926	8,375,000	103.39	11.32
1925	8,414,000	96.25	15.45
1924	7,166,000	84.66	14.96
1923	5,030,000	82.90	15.60
1922	3,119,000	51.39	12.18
1921	1,703,000	28.53	6.16

* Based on stock outstanding at end of year.

On account of competition arising from over-production and consequent general price reductions the trend of earnings is mainly downward since 1925. Price conditions and building decline are likely to militate against recovery this year.

A recent favorable outcome of a wallboard patent suit is likely to be overestimated in its effect on prices. In view of the large increase in outstanding shares this year and in prospect that total earnings will be, at best, no larger than last year, per share earnings will probably decline further this year.

However, the company is in a good financial position, the balance sheet of December 31, 1928 showing current assets of $16,277,000 and current liabilities of $2,957,000 with a net working capital of $13,320,000. This compares with a net working capital of $12,485,000 on December 31, 1927.

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff or of the writer, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of Pit and Quarry, for which no responsibility in any way is to attach to this magazine or to any of its staff or to the writer or the firm with which he is attached.

Analyses of Individual Companies

(Continued)

Therefore, the common stock, which is currently quoted on the Chicago Stock Exchange around 68½ with a range since the first of the year of 45¼ to 76 and a 1928 range of 55 to 100 justifies at least moderate optimism for long pull holding, if for no other reason than the United States Gypsum Company's outstanding position in its field.

Johns-Manville Corp.
Quarterly Report

The following table is a brief statement of the earnings of the above company for the first three months of this year as compared with the corresponding period of 1928.

Quarters ending March 31	*1929	1928
Sales	$13,023,884	$10,038,574
Costs and expenses	11,785,230	9,153,951
Fed. taxes	132,565	106,918
Net profit	$ 1,108,089	$ 772,705
Earned per share (700,000 shares)	$1.30	$0.85

* 1929 includes and 1928 excludes earnings of Celite Company, Banner Rock Products Co. and Weaver Henry Co.

The Johns-Manville Corporation is one of the leading manufacturers of asbestos products. In addition to fireproofing and insulating materials its lines also include roofings, cements, electrical and automotive accessories, besides filtration materials which are used in sugar mills, oil refineries and sewage disposal plants. It is the exclusive selling agent for Travertine, which is a highly durable building stone, and it recently obtained rights from Italy to manufacture and distribute a seamless pipe made of asbestos fibre and cement.

The company has mines and quarries located in Arizona, California, Pennsylvania and Canada and also operates eight factories. Last year Johns-Manville Corporation acquired the Celite Company and early in 1929 absorbed the Banner Rock Products Co. and the Weaver-Henry Manufacturing Co. Recent rumors regarding a possible merger with the American Radiator and Standard Sanitary Corporation have been denied. However, the concern is following a policy of expansion and other consolidations are probable.

The net income gained forty-one per cent in the initial quarter, being equivalent to $1.30 per share on the common stock, as compared with $0.88 per share for like period in 1928. This growth sustains recent trends, shown by 1928 profits of $6.75 a share against $4.78 in 1927, and indications are that 1929 will set a new earnings record.

While undoubtedly a considerable portion of the greater business as shown in the above statement is due to the inclusion of certain properties not included in the preceding year, it is interesting to note that while sales increased by 30 per cent a gain in net profit of 43 per cent was reported. Prediction of this year's earnings in any way from these figures is rather useless, for the first quarter is usually the leanest of the four as is shown when the earnings in 1928 of $6.75 for the whole year are compared with the initial quarterly results of that year.

The common stock of Johns-Manville sells for approximately 184, returning a very nominal yield from the prevailing $3 dividend, which was, neverthless, covered by a wide margin last year. It has been the habit of this stock to sell on a very high ratio of market price to per share earnings and it experiences quite wide intermediary fluctuations. However, the company's strong position and its record for rapid earnings expansion makes the issue attractive, at present prices, for holding over a period of years, although it could recede sharply in a period of general market weakness.

International Salt Earnings

Reflecting the sharp earnings expansion during 1928, the International Salt Company has lately resumed dividends at the rate of $6 per share per year. During the year 1927 the company earned $5.38 per share on 60,771 shares outstanding. This was increased to $7.23 in 1928 and we are advised that further substantial gain will be registered in the current year. For the first six months ending June 30 of this year the International Salt Company and its subsidiaries reported a profit of $231,298 after fixed charges and sinking fund but before federal taxes, comparing with $3,108 during the first half of 1928.

Moreover, with business volume on the upgrade and prices unusually satisfactory, it is conservatively estimated that profits will increase sufficiently during the last six months to bring the total 1929 income to at least $10 per share.

The financial position of the company has been further improved since the end of last year and interests close to the concern are of the belief that the chances for an extra dividend later this year, will be good if earnings continue their upward trend. The stock has risen since last November from 53 to 90¾ and is currently selling around 73. At present quotations, which are equal to less than 8 times estimated 1929 per share earnings, it yields a liberal return of 8.2 per cent.

The consolidated income account for six months ended June 30, 1929, compares as follows:

1929	1928	1927	1926
Net after expenditures			
$411,531	$187,175	$348,387	$318,737
Fixed charges and sinking fund			
180,233	184,067	187,767	170,127
*Profit			
$231,298	$ 3,108	$160,620	$148,610

* Before federal taxes.

General Asphalt Company

Reporting net profit of $461,760, after interest, federal taxes, etc., equal to $1.41 a share on 210,614 shares of common after preferred dividends, in the six months ended June 30, General Asphalt Company experienced one of the best first half-year periods in its history. These earnings were in marked contrast to the $339,241 net loss in the similar period of 1928 and compared favorably with net profit of $624,805 in the first six months of 1926. In the latter year, perhaps the best on record, net profit for the full twelve months was $2,001,991, or $8.11 a share on 201,115 common shares.

The greater proportion of General Asphalt's earnings is realized in the latter half of the year, and particularly in the last four months, when a large amount of roofing and paving business is done. In 1928 operations in the last six months converted a loss of $339,241, reported for the first half, into net income for the year of $920,506, after depreciation, interest, federal taxes, etc., equivalent to $2.78 a share on the 210,577 shares of common stock after 5 per cent preferred dividends.

Based on results for the first half of 1929, earnings for this year should run well ahead of 1928. Trading account for last year shows cost of machinery and appliances, largely electric, refrigeration of $1,118,869, whereas sales value was only $473,934, so that selling loss from this business amounted to $644,935. Elimination of the unprofitable electric refrigeration line has removed any further charge against earnings on this account.

The sources of the company's supply of asphalt are the Island of Trinidad and the Bermudez asphalt lake in eastern Venezuela. In 1928, its production of native asphalt totaled 246,357 tons, compared with 298,315 in 1927 and 284,225 in 1926.

NON-METALLIC TRAFFIC PROBLEMS

Conducted by M. S. Allison

Cement

Western Trunk Line Committee Docket No. 6208C contains proposal to establish new rate bases on cement in five ply multiple wall paper bags less than carload.

The present rating is fourth class and the proposed bases are 200 per cent of the carload rate on cement.

Agstone

Western Trunk Line Committee Docket No. 6962 proposes reduction in rates on Agricultural Limestone. Carloads from Dubuque, Iowa, to various points in Wisconsin. The following rates per ton of 2,000 pounds are representative:

	Present	Proposed
Cuba City	1.23	.90
Platteville	1.23	.90
Monfort	1.33	1.06
Lancaster	1.33	1.15

Phosphate Disodium

Western Trunk Line Committee Docket No. 2644F proposes to establish new rates on phosphate, disodium carloads from Chicago, Peoria, St. Louis, etc., to Colorado common points.

Present basis in class rates and proposed basis is same as on sodium, etc., in Item 6641 of E. B. Boyd's Tariff No. 111-g.

Sand and Gravel

By four complaints filed with the Interstate Commerce Commission, the Missouri Gravel Company allege that the rates on sand and gravel from La Grange and Reading, Mo., to destinations in Iowa, also Quincy, Industry and Littleton, Ill., are unreasonable and unduly preferential to competitors in Illinois, Iowa, and Missouri.

The complaints have been numbered Dockets 22420, 22421, 22422 and 22423.

These allegations bring into issue the rates of complainants' competitors.

Reciprocity

The Interstate Commerce Commission has instituted a general inquiry No. 22455 in the matter of reciprocity in purchasing their requirements and the possible influence the sellers routing of tonnage has thereon.

The commission's order reads in part as follows:

"It is ordered that the Commission upon its own motion, enter upon an investigation into and concerning the methods and practices employed by common carriers by railroad, subject to the interstate commerce act, in purchasing equipment, materials, with particular reference to the extent, if any, to which such purchases from any manufacturer, producer or dealer is dependent upon or influenced by the routing of traffic controlled directly or indirectly by such concern via the line or lines of the purchasing carrier, with a view to making such order or orders or taking such other action in the premises as may be warranted by the record."

All railroads have been made respondents and hearings will be announced later.

Feldspar

In I. C. C. Docket No. 22445 the Golding Sons Company, Trenton, N. J., complain of the rates on feldspar from Erwin, Tenn., Penland, N. C., Spruce, N. C., and Micaville, N. C., to Trenton, N. J.

Canada Gypsum

A despatch from Montreal states that the next meeting of the shareholders of Canada Gypsum & Alabastine, Ltd., on August 15 is to be held primarily to act on a four for one split. The directors will consider the dividend question and it is expected that there will be a substantial increase over the annual rate of $3.00 on the present shares. W. C. Pitfield has been added to the board of directors.

Question of Joint Rates Between U. S. and Can.

The question of jurisdiction of the Interstate Commerce Commission between points in the United States and Canada has been one of controversy for some time and various phases have been considered by the Commission and also have been before the Supreme Court.

About a year ago certain carriers filed tariff schedules proposing increased rates from Niagara Falls, Ont., to New York, etc., which tariffs were suspended by the I.C.C. and the proceeding assigned I. & S. Docket No. 3114.

A hearing was had and the I.C.C. issued its report in 151 ICC 207, wherein it was found:

1. Commission is without jurisdiction, in either a complaint or suspension proceeding, to consider the lawfulness of joint rates or proposed joint rates between the United States and points in Canada, except (a) for the purpose of ascertaining damages sustained in consequence of the breach, by the carriers, subject to its jurisdiction, of their statutory duty to make and publish just and reasonable rates applicable to that part of the transportation within the United States, and except, (b) that the commission may require the carriers subject to its jurisdiction to establish and maintain for the future just and reasonable rates applicable to that part of the transportation within the United States."

2. Orders of suspension vacated and proceeding discontinued."

The proceeding was reopened for further argument and after further hearing the I.C.C. issued its amended report in 155 ICC 488 wherein it was found:

1. Proposed increased joint rates on cyanamid and crude cyanide, in carloads from Niagara Falls, Ontario, Canada, to destinations in eastern trunk line from New England territories, Cincinnati, Ohio and Virginia cities, and concurrences issued with respect to such rates, found not justified.

2. Suspended schedules and concurrences ordered canceled and proceeding discontinued, without prejudice to the filing of the new schedules and concurrences in conformity with the views expressed herein.

3. Former report, 151 I.C.C. 207 reversed.

The basis of the I.C.C. reversal of opinion as to jurisdiction is very interesting and can be found in the report cited above.

"Aging" Cement Surfaces

A weathered or aged appearance is obtained on artificial stone or cement surfaces by applying a layer of soluble material to the surface during the molding process. The soluble substance, such as magnesium sulphate, is subsequently washed out, leaving a pitted surface on the stone. This surface may be scraped or brushed to produce special effects.—W. Maguire (British Patent 307, 132, B. C. A.).

LEGAL ADVICE TO NON-METALLIC PRODUCERS

Conducted by Leo T. Parker

When Principal Contractor Is Liable for Injuries Sustained by Subcontractor's Employee

The law is well established that a principal contractor may, under certain circumstances, be liable in damages for injuries sustained by his subcontractor's workmen.

For instance, in Kiehling v. Humes-Deal Co., 16 S. W. (2d) 637, it was shown that Humes-Deal Company was the general contractor for the erection of a building and was in possession and control of the building. They employed the Aetna Bricklaying & Construction Company as a subcontractor for the brick and tile work.

A bricklayer, employed by the subcontractor, was seriously injured as a result of stumbling over a loop of wire in the concrete near the place he worked. He sued both the principal contractor and his employer, the subcontractor, for damages, although the wire was left in its place by the concrete contractor.

The testimony proved that the loop of wire should, by application of ordinary care on the part of the principal contractor and the subcontractors, been removed because it was directly in the path which the bricklayer was compelled to take when going to the part of the building at which he was laying brick.

In view of the fact that the principal contractor had full control of the building, the court held this firm solely liable for the accident, stating important law as follows:

"There is no rule of the law better settled than that one (owner) who has contracted with a competent and fit person, exercising an independent employment, to do a piece of work, not in itself unlawful or attended with danger to others, according to the contractor's own methods, and without his being subject to control, except as to the results of his work, will not be answerable for the wrongs of such contractor committed in the prosecution of such work. . . . The Humes-Deal Company (contractor) was in possession and control of the building . . . its duty . . . was to use ordinary care to make the place reasonably safe for those whose duties called them to use it. In the exercise of such care it was obligated to at least make inspection. . . . When an employee of one master is engaged in work in a place furnished by another who has sole control of such place during the course of the employment, and such employee is injured by reason of negligence due to an existing unsafe condition therein . . . then the one so furnishing the place is liable to such employee to the same extent as though the servant was his own employee."

Heavy Damages Allowed on Breached Contract

The case of Natural Rock Asphalt Corporation v. Carter, 297 S. W. 1114, involves several important points of the law on contracts.

The facts of the case are that the Natural Rock Asphalt Corporation purchased 100 acres of land, and leased 350 acres which contained a deposit of asphalt. The company installed a plant and equipment for the purpose of quarrying and crushing the material, and began to operate the plant. After producing about 3,000 tons of material, the company decided to let a contract for certain portions of the work incident to producing, transportation, and selling the material.

Therefore, on February 19th, the company and a man named Carter entered into a contract whereby Carter agreed to quarry, crush, and load on barges at the landing near the plant a minimum of 50,000 tons of natural rock asphalt between March 1st and December 31st, at a price of $1.45 per ton. The company agreed to furnish its plant and equipment then located at its quarry and the barges necessary to receive the asphalt.

Four months later Carter ceased operations under the contract and notified the company that he had abandoned it. At that time he had quarried, crushed, and delivered on barges 3,554 tons, whereas the contract provided that he should produce and deliver 1,000 tons in March, 3,000 tons in April, 6,000 tons in May, and 7,000 tons in June.

The company sued Carter for $200,000 as damages for breach of the contract. Carter filed a counter suit and asked for damages on the contention that he had been induced to enter into the contract by certain false statements of the company's sales manager that the company had a large crusher that would crush from 2,000 to 2,500 tons of material daily; that the material was as easily crushed as limestone; and that it was a steam-shovel proposition.

However, the testimony disclosed that when Carter visited the quarry before entering into the contract, he inspected the crusher and, being familiar with that kind of machinery, he could have easily determined its capacity for himself. At the time he visited the quarry, a large quantity of rock had been shot down on the floor of the quarry, and he could have determined for himself the character of this rock, and whether or not it could be handled with a steam shovel.

The lower court held the company liable to Carter for $5,000 damages, but the higher court reversed the decision and, in holding the company entitled to recover heavy damages from Carter, said:

"A party who claims to have been defrauded in the execution of a contract must assert this defense within a reasonable time after a suit has been brought against him, to enforce the contract, or within a reasonable time after he has discovered the fraud, or else he will be deemed to have waived his right to rely on the alleged fraud in the execution of the contract. . . . The measure of damages for the breach of the contract, so far as failure to produce the material is concerned, is the difference between the price that Carter was to receive for quarrying and crushing the material and delivering it on barges and what it would reasonably have cost the company to have the same work done after Carter abandoned the contract, or what it actually cost the company to do the work, provided it operated the plant in a reasonable prudent manner."

When Verbal Agreements Vary Written Contract

The general rule is that parol evidence will not be received by a court to contradict or vary the term of a written contract, and that when an agreement is reduced to writing it must be considered as expressing the ultimate intention of the parties to it.

Therefore, in the absence of fraud, parol evidence is not admissible to alter or modify the terms or legal effect of the written contract.

However, it is important to know that there is one important exception

to this general rule which permits the introduction of evidence of verbal promises independent of the provisions in the written agreement, although the verbal promises affect the rights of the parties in relation to the subject-matter of the writing. In such cases, the contract is deemed only partially reduced to writing and the verbal promises are a part of the complete contract.

For example, in Johns Corporation v. Heckart, 277 Pac. 821, it was disclosed that a salesman verbally guaranteed the quality of plaster material, although no guarantee of quality was written in the contract of sale. Printed on the order form was the following quotation: "It is agreed there are no promises, agreements or understandings not expressed on this form."

When the plaster material arrived the purchaser refused to accept the shipment, because the goods did not equal the verbal warranty made by the salesman. The seller sued the buyer, contending that the latter was bound to accept and pay for the merchandise in view of the printed notification on the contract.

The buyer filed a counter suit asking for $500 damages which he sustained as a result of not receiving the quality of goods verbally warranted.

Moreover, it is interesting to observe that the court held the buyer not required to accept and pay for the goods and held the seller liable for $500 damages, stating important law as follows:

"To render a writing an entire contract as to exclude parol evidence of terms not contained in it, it must appear that it contains all of the material terms of the contract; for if it does not, and a material portion of its terms have to be supplied by parol, then the entire omitted portions of the agreement may be proved by parol. . . . The provision contained in the written contract, which states, 'It is agreed there are no promises, agreements or understandings not expressed on this form,' is not controlling, for the whole evidence shows that that statement was not true."

Material Lien Held Prior to Subcontractor's Homestead Exemption and Funeral Expenses

Generally speaking, homestead and funeral expenses are exempt from ordinary claims of all other creditors. However, in Penniman Gravel & Material Co. v. Hutton, 16 S. W. (2d) 848, it was disclosed that a home owner, named Hutton, contracted with a principal contractor whereby the latter agreed to build a dwelling on his lot. The principal contractor sublet a part of the contract to a subcontractor who purchaser various materials from a gravel company for use in the building.

Soon after the subcontractor completed his contract he died, leaving an insolvent estate consisting of his home, on which he owed its full value. His funeral expenses amounted to $610 and the principal contractor owed him $700. The gravel company filed a mechanic's lien against Hutton's house. The lower court held the homestead exemption and funeral expenses prior to the lien, but the higher court reversed this decision, holding the gravel company entitled to collect its bill, irrespective of the homestead exemption laws and the funeral expenses, saying:

"We are clearly of the view that the materialmen's liens were superior to the several claims and charges asserted by the administratrix. The constitution creates a lien . . . and, it includes materialmen, who furnish material, though to a subcontractor, as well as those who furnish it to an original contractor."

City Ordinance Held Invalid

For illustration, in Davison, 13 S. W. (2d) 40, it was disclosed that a municipality enacted an ordinance, as follows:

"No stone quarry shall hereafter be . . . established on any lot of ground or in any building within a distance of three hundred feet of any inhabited building."

The owner of property, within 300 feet of an inhabited building, opened and operated a stone quarry, and filed suit to prevent enforcement of the law which prohibited him from conducting the business, on the contention that, since he did not intend to use explosives, the ordinance violated both the state and United States constitutions which prohibit taking private property without just compensation.

Therefore, the question presented in this case is: Has a city the right to prohibit the use of property for a purpose which is not a proved nuisance and not injurious to the health, morals, or safety of the community?

It is important to know that the court held the ordinance void and unenforceable, saying:

"It is fact well known that a stone quarry may be opened up and operated without the use of explosives, in which event no injury to individuals or to property would result. . . . In this day of greatly increased population of cities and towns, the legislative body of such municipality has the power to make necessary and reasonable regulations regarding the use of the property therein. Often it has been held that such regulation does not deprive the citizen of the use of his property, but simply prohibits him from the use thereof for purposes deemed objectionable. . . . The owner of property has the right to use the same in any manner he may see fit, consistent with the rights of others. . . . The effect of the ordinance absolutely prohibiting the maintenance or operation of a rock or stone quarry within certain designated limits of the city is to absolutely deprive the owners of real property within such limits of a valuable right incident to their ownership, viz., the right to extract therefrom such rock and stone as they may find it to their advantage to dispose of. . . . A city cannot prohibit the use by the owner of his property simply because in the use thereof he might do something that would be injurious to others."

Seller of Property Not Liable For Damages Caused by Gravel Company

It is important to know that a person who sells property is not impliedly liable in damages for injuries caused the purchaser.

For illustration, in Bohon v. Puget Co., 271 Pac. 580, it was disclosed that a company, which owned a tract of land, sold a few acres to a raiser of chickens named Bohon. Later the company sold a tract adjoining the chicken farm to a person named Ward who operated a gravel pit.

Bohon sued the company for damages, alleging that the dust from the pit and loading killed his chickens. However, the court held the seller of the property not liable, saying:

"It seems to us . . . that Bohon should not be awarded recovery against the company, as claimed by him. It seems plain to us that the company has not been shown to have violated any of its contract obligations owing to Bohon, nor has it been guilty of any false or fraudulent representations inducing Bohon to enter into his contract of purchase of the four-acre tract. If the maintenance of the plant by Ward can be held to be a nuisance by reason of its annoying or offensive character, he, and not the company, is responsible therefor; and, to the extent that it is a damage to adjoining properties, their owners have recourse to the courts directly against Ward."

PIT AND QUARRY FOREIGN DIGEST

Conducted by C. P. Harris, Ph.D.

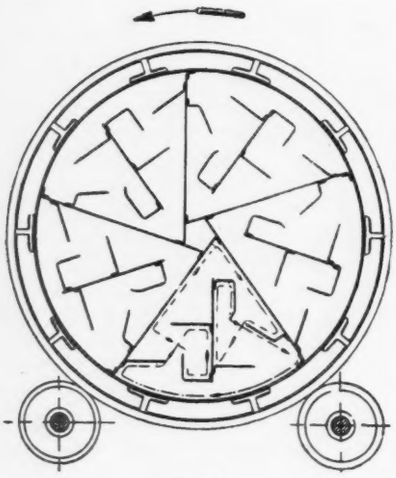


Fig. 1

New Rotary Driers

Although rotary drums, whose interiors are divided into cellular shape, are known, a new departure in construction involves the use of 4-6 large cells so that the material will not be stopped in passage, if it is pasty. It is also suitable for hard and sharp edged substances. It can be easily cleaned. This is shown in Figure 1. For finely divided materials the arrangements are shown in Figures 2 and 3. With other systems there is danger of overburning some of the goods due to the higher temperature in the center. This is not the case with these driers. The material remains in a large section and moves from the cooler outer zone to the hotter inner one and back again. There is no danger of overburning, and a uniform product results. This system can be rigged in old drier installations and is claimed to increase the capacity up to 100 per cent.—Eberts (*Zement*, June 20, 1929).

The Structure of Leucite and Complex Kaolinates

Leucite is interpreted as a derivation of a kaolin anhydride. Its structure approaches that of orthoclase, both natrolite radicals of the kaolin nucleus being linked to potassium silicate nuclei so that the kaolin nucleus is not completely saturated. The structural formula proposed for leucite accounts satisfactorily for all changes of the mineral. From the structural diagrams of andalusite, sillimanite and kyanite the structural isomerism is evident, which is in agreement with the stability of the individual members. These three minerals are assumed to be common kaolin aluminates. The possibility of the existence of an ordinary aluminum silicate differing from the mentioned minerals is discussed. The constitution of andalusite is analogous to that of topaz. The difference consists in Al = O groups of the former being displaced by Al = F_2 groups in topaz, which is a kaolin fluo-aluminate. The same constitution must be ascribed to the tourmalines, in which B is linked to the aluminate side of the kaolin nucleus; that is, to the natrolite radicals. A total analogy is found between orthoclase and beryl. Both natrolite radicals of the kaolin nucleus in the 8 Al radicals are saturated with 8 Be-silicate radicals. Euclase, a derivative of beryl, is interpreted as a basic Be-kaolinate.—M. Dominikiewicz. Roczniki Chem. *8*, 542-52 (German resume 552-3, 1928) C. A.

The Setting of Cement

A study has been made of the loss in weight for H_2O in cement during hardening. Experiments were carried out over many concentrations of H_2SO_4 starting with a fixed initial ratio of H_2O to cement. Data were obtained on change of weight with time extending over periods as much as 200 days. One set of experiments was made with ordinary portland cement and another in which no gypsum was present. The results in the two cases are practically alike. A hydrate especially noticeable with freshly set cement is shown in both cases at about 10.4 mm. Hg, which slowly disappears with age. The practical application of vapor-pressure isotherms is discussed. Just how important gypsum content is compared to other factors such as grain size cannot be determined by these experiments only. Hydration is evaluated from volcanic change with aging. Greatest contraction occurred after 2 days' setting. These results accord with those from isotherm determination.—Hermann Gessner. Kolloid-Z. 47, 160-75 (1929). Cf. C. A. 23, 1732. C. A.

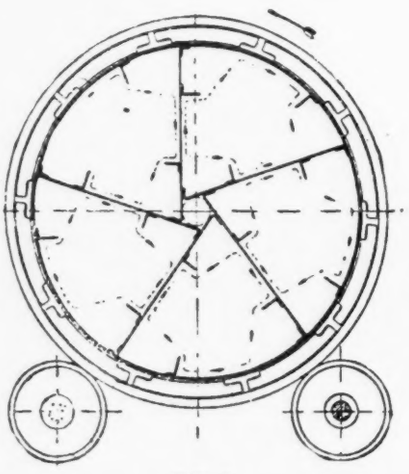


Fig. 2

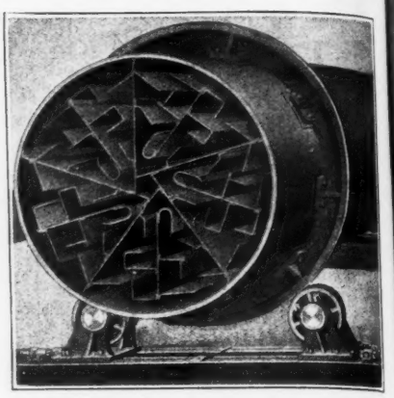


Fig. 3

The "Best" Cement Slip Composition

The older method of calculating the slip composition was based upon the hydraulic modulus M. This formula, where x is the amount of limestone to be used, is:

$$x = \frac{M.\ (SiO_2 - Al_2O_3 - Fe_2O_3) - CaO\ \text{(for clay)}}{M.\ (SiO_2 - Al_2O_3 - Fe_2O_3) - CaO\ \text{(for limestone)}}$$

The hydraulic modulus does not occur in the new formula where y is the amount of limestone:

$$y = \frac{2.8\ SiO_2 - 1.1\ Al_2O_3 - 0.7\ Fe_2O_3 - CaO\ \text{(for clay)}}{2.8\ SiO_2 - 1.1\ Al_2O_3 - 0.7\ Fe_2O_3 - CaO\ \text{(for limestone)}}$$

Whereas the old formula presupposes a knowledge of the "correct" hydraulic modulus the new formula obtains the "best" raw slip composition without assumption. The "ideal" raw slip composition is approached by this method, with the highest possible lime content; but once this is known, it is easy to deduce from it the proportions which will give the best practical raw slip mixture.—Hans Kühl (*Zement*, July 4, 1929).

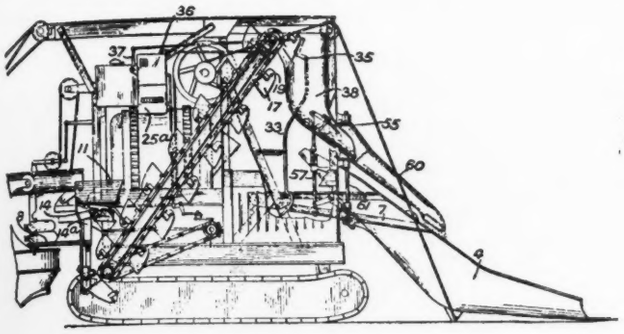


Fig. 1

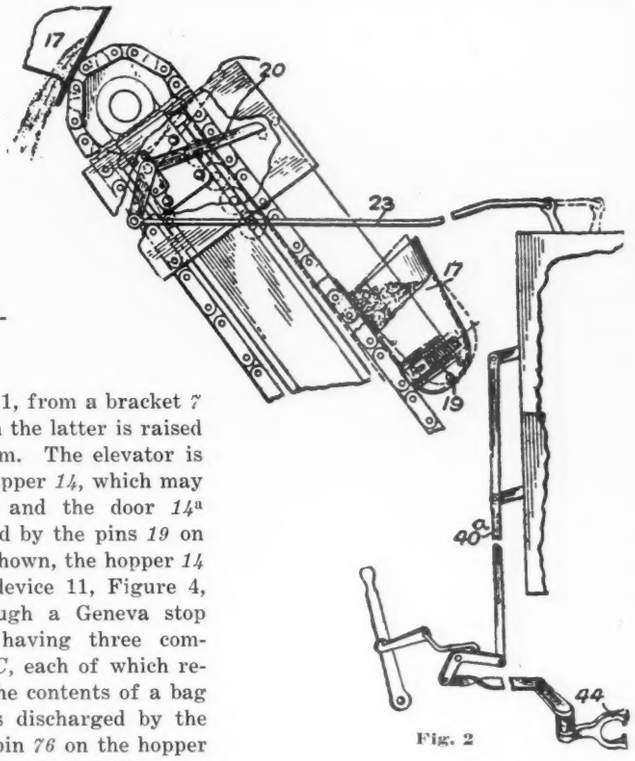


Fig. 2

Mixing Concrete

A concrete mixer is provided with means for measuring the quantities of cement and water in each batch, and registering the number of batches. The measuring device comprises a bucket elevator in which each bucket, holding a predetermined quantity of cement, operates a counter, the setting of which determines the number of buckets of cement constituting the charge for the batch; the counting mechanism operates a registering device for the number of batches, and controls the hoisting gear for the loading skip, and the water supply. In another form, the water supply for each batch is counter-balanced by the weight of cement for the batch. In the form shown in Figure 1, the cement is charged into a shoot *38* by a bucket elevator. The buckets *17*, Figure 2, of which are mounted on springs so that when loaded pins *19* thereon will operate a lever *20* connected by a link *23* with a counter *25*, Figure 3. The counter comprises a ratchet disc *27*, which is rotated step-by-step against a spring *32* by a ratchet *26* operated by the link *23*. The disc is provided with a number of holes for the reception of a stop *29*, which, after the disc has been moved a number of steps, depending on the setting of the stop *29*, operates a lever *39*, by means of which, through a link *40*[a], Figure 2, a clutch *44* is thrown out to stop the bucket elevator; simultaneously, a bell *48* is rung and a register *25*[a] operated. The disc is reset by the release if a detent *31* through a lever *37* and linkage *36*, *35* and *33*, Figure 1, from a bracket *7* on the skip *4* when the latter is raised to charge the drum. The elevator is charged from a hopper *14*, which may be fed by hand, and the door *14*[a] of which is tripped by the pins *19* on the buckets. As shown, the hopper *14* is charged by a device 11, Figure 4, reciprocated through a Geneva stop mechanism, and having three compartments *A*, *B*, *C*, each of which receives, by hand, the contents of a bag of cement, and is discharged by the engagement of a pin *76* on the hopper *14* with a trip lever *77*, which opens bottom doors *78* through toggles *77*[a], *77*[b]. The bags of cement are taken from a platform *8*. In this form the water supply is controlled by the upward movement of the rod *33*. The shoot *38* is discharged through a door *55* operated by a spring influenced rod *57* from the skip as it is raised; it discharges into a spout *60*, which pours it into the skip and is then moved laterally about a pivot *61* to clear the rising skip. In the form shown in Figure 5, the hopper *38*[a] for the cement is mounted on pivoted arms *87* and is counter-balanced on arms *90* by a tank *92*, which is filled from a pipe *94* through a valve *95* operated by a link *98* connected to an arm *99* on one of the balance arms *90*. The hopper, charged with the cement, raises the tank, the movement of the arm *90* opening the valve *95*; when the tank is filled to a weight determined by the charge of cement, it descends and so closes the valve *95*. The cement is discharged, in this case directly into the drum, by the operation of a door catch *86* by the rising skip *4*; simultaneously the water is discharged by the actuation of a valve *103* by a spring-influenced member *108*, which also operates the batch counter *5*[a].—J. F. Robb.

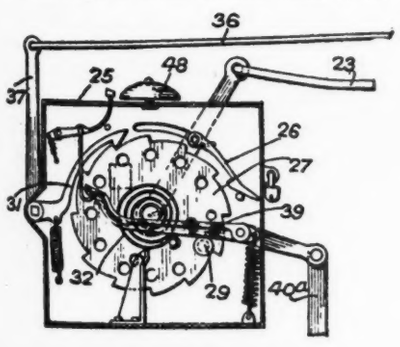


Fig. 3

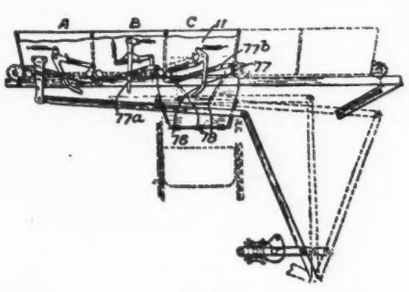


Fig. 4

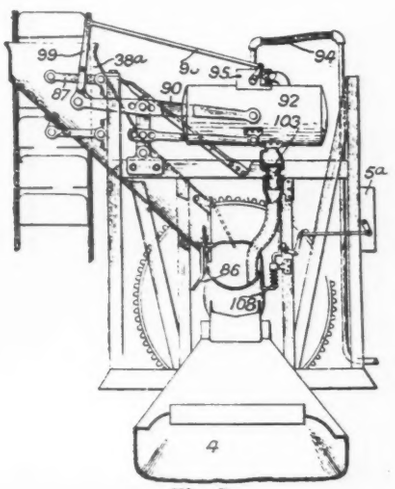


Fig. 5

Temperature Rise Observed on Solidification of Mixtures

Uchida measured the time required for the solidification and the accompanying temperature rise of portland cement mixed with 1, 2, 2.5, 3, 5, 7, 10 and 20 per cent $CaCl_2$; similar measurements were made with 3:1, 2:1, 1:1 and 1:3 mortar prepared by mixing 3 per cent by weight of $CaCl_2$ with cement. The increase of the $CaCl_2$ content lessens the time of solidification, the heat evolution increasing irregularly.—Shichiro Uchida (Sendai Higher Tech. School), 6, 381-7 (1928). Cf. C. A. 22, 673, C. A.

INTIMATE NEWS OF MEN AND PLANTS

Pacific Coast Aggregates Completing Merger

Details in connection with the formation of the Pacific Coast Aggregates, Inc., into a sand, rock and gravel consolidation, with holdings valued at $20,000,000, were announced on July 25. Public offering of two security issues totaling $5,500,000, were made July 26 by a group of California and Eastern bankers.

The banking group marketing the issue is headed by America Investment Company, Anglo-California Trust Company and California Company. Other investment houses in the underwriting are: Banks, Huntley & Co., Bradford, Kimball & Co., California Securities Company, Anglo London Paris Company, M. H. Lewis & Co., Drake, Riley & Thomas and California National Company.

The larger issue consists of $4,000,000 first mortgage 6½ per cent sinking fund gold bonds. The smaller issue consists of $1,500,000 ten-year sinking fund 7 per cent convertible gold debentures. Both issues carry common stock voting trust allotment certificates attached and both will form a direct obligation of Pacific Coast Aggregates, Inc.

Sixteen large producing and distributing companies engaged in the sand, rock and gravel business in the San Francisco Bay region and in Central and Northern California from Oroville to Fresno and Monterey.

The list of companies includes Acme Gravel Company, Associated Gravel Company, American River Sand and Gravel Company, Ameriver Sand Company, Bay Development Company, T. I. Butler Company, Inc., California Rock Co., G. & M. Gravel Company, Piedra Rock Company, California Building Material Company, Pratt Rock and Gravel Company, Rhodes, Jamieson Company, River Sand and Gravel Company, Santa Clara Gravel Company, Vulcan Rock Company, Golden Gate Atlas Company, and Coast Rock and Gravel Company.

Norman B. Livermore, director of Crocker First National Bank and Pacific Gas and Electric Company, and president of California Building Materials Company and Coast Rock and Gravel Company, is president of Pacific Coast Aggregates, Inc.; and George G. Jamieson, president of Rhodes-Jamieson Company, is vice-president. Directors include William H. Ford, president of Associated Gravel Company; F. W. Kiesel, president of California National Bank of Sacramento; Louis Sutter, vice-president of Anglo-California Trust Company; Silas H. Palmer, vice-president of Holbrook, Merrill & Stetson, and representatives of the various investment companies.

Sand Companies Merge

Announcement was made recently of the merging of the Monessen Sand and Gravel Company of Monessen, Pa., with the Rodgers Sand Company of Pittsburgh, one of the largest and most substantial firms in the country, with half a dozen plants located in Western Pennsylvania.

Noll Named Receiver

Frank J. Noll was recently appointed receiver for the Marion County Sand and Gravel Company of Indianapolis, Ind., by Judge Joseph M. Milnor in Superior court. The receivership action was a friendly one, brought by the law firm of Robinson, Symmes & Melson and other organizations, in an effort to place affairs of the company on a sound basis.

A Correction

Through an error, the picture of Paul Morie, general superintendent of the Cleveland Quarries Company, reproduced on page 78 of the July 31 issue of PIT AND QUARRY, was designated in the caption below it as that of R. H. Clifford, who wrote the article describing the company's operations. In order that there may be no doubt as to the appearance of the man who is largely responsible for the success of the company's quarries, we are reproducing Mr. Morie's likeness herewith.

Paul Morie, general superintendent

Parker Gives History of Cement Making

"The Cement Age" was the topic of a talk at the Gilroy, Cal., Rotary club on July 18 by Frank Parker of Hollister, manager of the Pacific Portland Cement plant at San Juan. The speaker stated that cement was the oldest building material of which any record exists and told of its use thousands of years ago by the Egyptians and Romans.

He explained how an Englishman discovered its practical use again in 1824 and gave a history of its rapid progress as a building material. In 1880, Parker said, the output of cement was between 80,000 and 82,000 barrels, while last year it amounted to 201,000,000 barrels.

He said there are 23 plants on the Pacific Coast with 12 in California, representing many millions of dollars. The San Juan plant, a comparatively small one, manufactures 27,000 barrels a day.

County Commissioners Purchase Stone Quarry

The county commissioners of South Bend, Wash., recently authorized the purchase of the Baird's Hollow Rock quarry from the Journal Building Company of Portland, Ore., for the sum of $1,250. The board ordered the auditor to draw a warrant for $300 payable upon the disposal of a condemnation suit between the two involved parties, The Journal Co. and Pacific county. Another warrant for $950 is to be drawn within a year from July 10, 1929, provided the board authorizes it.

They also ordered the graveling by force account of 5,450 feet of road on lower Smith Creek from Wm. Smith's place to the Alva Soule place at an estimate cost of $5,932. Work was started August 1 and will end September 1. The estimated cost per yard of gravel is $3.11.

Portland Firm Get Cement Award

The United States Bureau of Reclamation has awarded the contract for delivery of 75,000 barrels of cement to be delivered at the Dunway siding, Owyhee reclamation project, to the Oregon Portland Cement Company, Portland, Ore. The award was made at $2.951 per barrel sacked, and $2.50 in bulk.

NEWS OF EQUIPMENT MANUFACTURERS

Gravel Equipment Discussed

The Pioneer Gravel Equipment Manufacturing Company is distributing an 80-page illustrated catalog that is entirely devoted to the discussion of equipping sand and gravel plants. It identifies, by number, the different sizes and capacities of completed plants as installed by this company. It manufactures different classes of conveyors, elevators, grizzlies, screens, bins, draglines, chains, crushers and repair parts for different types of equipment.

Barometer and Vacuum Recorders Described

The Uehling Instrument Company has published a new 6-page bulletin No. 150 describing the Uehling combined barometer and vacuum recorder which is an instrument for steam turbine operation. It is said to be a dependable instrument and shows the absolute back pressure at a glance and enables the operator to maintain the highest vacuum possible for a given barometer reading. It also gives a picture of operation, shows the exact time when anything happens to cause a drop in the vacuum and enables one to correlate the factors that might have caused the interruption in service.

A Demountable Troughing Idler

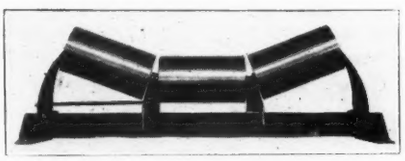
This latest type Robins idler is similar to the well-known 203 XR three pulley Timken bearing idler, with the exception that it has demountable pulleys.

The three pulleys with their bearings and grease seals are identical and interchangeable. Each is of cast iron with totally enclosed ends. There are no dirt pockets. Each pulley with its dead shaft of heavy seamless cold drawn tubing can be lifted out without the use of tools except to disconnect one section of the grease line leading to the center pulley.

The side pulleys are set at an angle of 20 degrees from the horizontal, thus giving high capacity without bending the belt enough to impair its life. The gap between the pulleys is about ¼ in., making it impossible for the belt to be caught or creased at this point.

In assembling the idler, accurate adjustment of the roller bearing is made by the threaded sleeve on the end of the shaft. Subsequent wear on rollers or races is taken up by the coil spring which presses against the inner race. The sleeve on the end of the shaft is notched to fit the forked ends of the malleable iron supporting brackets.

The brackets between the pulleys and at the ends of the idlers are of malleable iron. They are bolted to a structural steel angle base, which has a maximum of stiffness and also has the advantage of being self-cleaning, so that dirt cannot accumulate under the center pulley. This base, as in all Robins' idlers, is of such a length as to provide 6-in. clearance at both sides of the return strand of belt.



The troughing idler

Lubrication of the six roller bearings is provided by means of grease forced through three high pressure fittings. Each fitting supplies grease to a reservoir in the hub of one pulley and to the two bearings mounted in that hub. All fittings are located at the ends of the idler where they will not be overlooked and where they can be served without reaching under the belt. The fittings supplying the side pulleys are mounted directly on the ends of the hollow steel shafts. The fitting supplying the center pulley is mounted on a pipe running through the end bracket and up one of the center brackets to the hollow shaft of that pulley.

Protection of each bearing against the loss of grease or the entering of grit or moisture is provided by a double labyrinth seal and a wide felt washer. Standard sizes range from 18 in. to 60 in.

Silos Can Be Increased To Meet Conditions

The question is often asked, "How much tonnage should a dealer have before installing silos?" One dealer in the Philadelphia area undertook to answer it by building one of the L. H. Blouch Company's Economy plants. His tonnage had outgrown the portable machinery stage and he was trying to make a decision on his next step.

About this time he received in the mail an L. H. Blouch & Company circular quoting prices of a silo plant completely erected. While this plant did not exactly meet his conditions, he decided to investigate its possibilities.

He found that the silos, due to their being Neff & Fry stave type of construction with pointed ends, could always be raised or torn down and rebuilt in larger sizes. Along these same lines it was easy to adapt the Godfrey conveyor with two new cables and a few more feet of I-beam track when the silos are rebuilt of larger diameter or more silos added. In his case a ground storage section is also being used. The plant has been in operation for more than a year, and Edgar J. Bittner, E. Tabor Rd., Philadelphia, Pa., will be glad to give you his experience.

Chain Works Changes Hands

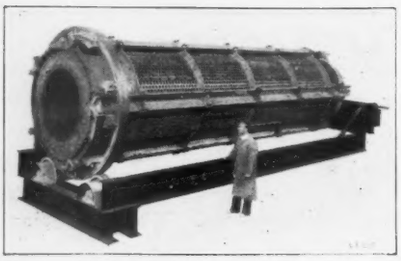
Negotiations have been completed by the Newhall Chain Forge and Iron Company for the purchase of the chain shop and other buildings of the Rensselaer Chain Works, an old established chain manufacturing plant, together with adjoining properties to permit of extensions.

The Rensselaer Chain Shop is equipped particularly for the manufacture of the better grades of hand made, heavy duty chains and has been under the exclusive operation of the Newhall Company for a number of years, where it has manufactured the Warwick dredge, crane, conveyor and sling chains together with some special Trident steel loading and dredge chains.

Benjamin R. Smith, well-known in the chain industry, and who was superintendent of the Rensselaer Shop while it was under the operation of the Newhall Chain Forge and Iron Company, passed away in his eighty-third year on June 14.

Mr. Smith was active in the shop to within a week of his death, and his place has been taken by his son Samuel Smith, who has been a practical chain maker all his life and who, in late years, has been relieving his father from many duties.

The Newhall Chain Forge and Iron Company is one of the divisions of tne Henry B. Newhall Corporation, other divisions being the New Jersey Foundry and Machine Company and the Diamond Expansion Bolt Company.



New roller-bearing screen

All Roller Bearing Screens for New Ohio Gravel Plant

In the new plant of the Van Camp Sand & Gravel Co. at Lebanon, O., every piece of machinery will be equipped with anti-friction bearings. Illustration shows one of the screens, a 72-inch Telsmith-Hercules, built by the Smith Engineering Works. This screen is equipped throughout with Dodge-Timken Roller Bearings and has a capacity of 300 cubic yards of sand and gravel per hour. It has an extra heavy frame, all gears are enclosed and special protection is provided for the bearings.

The Van Camp plant, which is rapidly nearing completion, will have a daily capacity of 3,000 cubic yards of washed sand and gravel. The 72-inch screen will be used as a scalper to precede two 60-inch Telsmith-Hercules washing screens, one of which will be used for classifying gravel and the other for the production of crushed stone. Arrangements are provided for diverting the flow of material from one screen to the other as may be necessary. These two 60-inch screens are also being built by the Smith Engineering Works and equipped with Dodge-Timken Roller Bearings.

Falk Accepts Responsibility In National Metal Trades

Harold S. Falk, vice president and works manager of the Falk Corporation, has been appointed chairman of the Committee on Industrial Education of the National Metal Trades Association.

The association has been extremely active for many years in educational activity and this has become one of the most important phases of its work. Apprenticeship has been stressed in particular and the training of young men has been as fully developed in the machinery building industry as in any other. Moreover, considerable stress has been placed in recent years upon foremanship conferences.

During the last seven years Mr. Falk has been chairman of the Apprenticeship Committee of the Milwaukee Branch of the National Metal Trades Association and under his direction the number of apprentices in the Milwaukee district has grown from 460 to well over 1,000 in that time. He has worked out the principle that the training of engineers and mechanics for any industrial district is the joint responsibility of all the manufacturers in the district and is not a problem for the individual manufacturer only. Accordingly, practically all metal trades manufacturers in the Milwaukee district are playing their part in the educational program under the direction of the General Committee. Mr. Falk is also a member of the Committee on Education and Training for the Industries of the American Society of Mechanical Engineers.

Time Current Control

The Electric Controller and Manufacturing Company is distributing an illustrated 4-page circular that is concerned with the statements that: Time current control increases production, reduces delays and gives better protection. The circular contains oscillograph curves taken with a 20-hp., 230-volt mill type motor and an E&M time controller.

Cement Mills Install Additional Dustcollecting Equipment

Additional Norblo dust-collecting equipment is now being installed at the finish grinding plant of the Standard Portland Cement Co., Painesville, Ohio. It is also stated that the Marquette Portland Cement Co., of LaSalle, Ill., has ordered equipment of the same type for its hammer mill department, this being the sixth order for Norblo dust-collectors which it has placed within the last year.

A New Unit Heater

The new development of the Young unit heater is the application of the unit in a recirculating box with various numbers and sizes of units, one to four assembled in these recirculating boxes. This is a particularly interesting development for automobile factories, garages, warehouses and is a most efficient type of forced heating, much less expensive than the ordinary type of cast iron radiation, steam coils, etc. It is also beneficial to the workmen's health and acts as a ventilating system at the same time.

These units are the development of a great amount of research experience in the manufacture of heating units and its application to a recirculating box makes a very flexible type of construction of special interest for shops, garages, warehouses, factories, etc.

Mills That Grind Cement

The Traylor Engineering and Manufacturing Company is mailing a 7-in. by 12-in. folder to its clients and prospects. This folder is concerned with giving the brands of cement that are being ground in Traylor mills.

Magnetic Manufacturing Appoints Representative

Magnetic Manufacturing Company announces the appointment of Wells, Fargo and Company, S. A. Mexico, as its exclusive representative for the entire Mexican territory, with A. J. Hiern as manager.

Sand-Lime Brick And Slag Brick Equipment

The Komnick Machinery Company, Incorporated, is distributing a 12-page illustrated bulletin describing sand-lime brick and slag brick machinery. The bulletin gives considerable information regarding the manufacture of these building materials and directs interested parties to the statement, "Let Komnick engineers do your worrying." This offer is made without obligation to producers of the material that can be used in sand-lime or slag brick.

Recirculating box for floor mounting. Models 212 and 309 operate more efficiently with recirculating box.

New Model "A" Hydraulic Hand Hoist

The Wood Hydraulic Hoist & Body Company has announced its latest type hoist in the July number of the *Wood Hoister*. It utilizes the well-known hydraulic principle, with a rotary gear type oil pressure pump to supply the pressure. Power is applied to the oil pump by a hand crank on the right side of the chassis. Oil under pressure is pumped into the cylinder facing the piston and piston rod outward.

In construction, the unit reflects the same careful construction as other Wood units. The pump body is nickel-iron, pump gears steel cut, pump valve is brass and the hoist sub-frame is of structural steel.

Shovel Firms Move Offices

The Thew Shovel Company and the Universal Crane Company announce the removal of their Pittsburgh office to Suite 1806, Benedum-Trees Building, 221 Fourth Avenue, Pittsburgh, Pa.

New Concrete Handling Booklet Compiled By Barber-Greene

A new book on wet concrete handling, called "New Applications and Set-Ups," has been compiled by the Barber-Greene Company. It is a 28 page book, profusely illustrated, covering thoroughly the multiple applications of Barber-Greene belt conveyors on concrete construction jobs.

Among the jobs described in the book is the construction of the new Marshall Field Merchandise Mart Building, the largest building in the world, on which 55 Barber-Greene belt conveyors are being used to handle the dry aggregate and to carry the wet concrete to the forms. Another job described is the building of the Brandon Locks at Joliet, Illinois, on which two Barber-Greene belt conveyors with special B-G Feeding Hoppers poured the wet concrete on both the lock and retaining walls.

"New Applications and Set-Ups" covers the use of belt conveyors in the construction of buildings, sewers, sewage disposal plants, bridges, irrigation ditches, viaducts, railroad elevations, and retaining walls. Some of the construction jobs described are: The 2,700 foot Seventh Street Viaduct at Decatur, Illinois; the Los Angeles flood control project; the new T. and O. C. Docks in Maumee Bay, Toledo, Ohio; the West Side Sewage Works, Chicago; and the Mitchell Junior High School, Denver, Colorado.

Torch Welding Described

The Torchweld Equipment Company is distributing its new catalogue No. 29, which is 8½ by 11 in. containing 40 pages and covers the complete Torchweld line with cross sectional views of gas welding and cutting, lead welding, soldering, brazing and decarbonizing equipment, automatic and hand welding and cutting machines and torches, gas pressure regulators, acetylene generators, welding supplies and general information.

Empire Steel Reorganized

Empire Steel Castings, Inc., has recently been incorporated to take over the business and assets of the Empire Steel Casting Company. The company will carry on the business developed by the late company in high grade electric alloy and carbon steel castings.

The officials of the new organization are: Frank Hodson, president; directors, Charles Shipman Payson, Wallace E. Belcher, J. A. Osherman, D. W. Phillips; secretary-treasurer, J. E. Horton.

Crawler Equipment Described

The Northwest Engineering Company is distributing a profusely illustrated, 100-page, bound catalogue that features its shovels, cranes, draglines, pull shovels and skimmer-scoops. The catalogue is especially indexed and classified for ready reference and the convenience of its clientele. Each section is introduced by a beautiful photograph in colors, that illustrates it.

The special sections are titled, shovel installations, crane installations, dragline installations, pull shovel installations, skimmer-scoop installations, detailed construction, crowding mechanism, the Northwest cab, Northwest power plants, Northwest variable speed motor, operating ranges and capacities and a large list of operators who use Northwest machines.

Bay City Office Building Nearing Completion

Henry C. Weber Construction Company, of Bay City, Mich., has started work on its contract for a new office building for Bay City Shovels, Inc. (formerly Bay City Dredge Works), continuing the program of expansion. The new building is being located on the shovel company property adjoining the factory and is of modern fireproof construction, reinforced concrete foundations and floors with hollow clay tile and face brick walls. Three fireproof storage vaults are to be provided, one on each floor. The top floor will be occupied by the drafting room and engineering department, as well as an auditorium. The building is expected to be ready for occupancy early in October.

This announcement is made coincident with the completion of a new fireproof factory building equipped with an electric overhead traveling crane and containing 18,000 sq. ft. of floor space available for the assembly department. This expansion has been made necessary due to the popularity and demand for Bay City power shovels, and the machine shop division is continuing to operate day and night shift.

A New Data Book

The Chain Belt Company and the Stearns Conveyor Company, a branch of the Chain Belt Company, specializing in belt conveyors, are distributing the new Rex 330 Catalogue and Engineering Data Book—an 800 page publication describing the company's complete line of chains, power transmission equipment, water screening equipment and elevators and conveyors for the mechanical handling of material. In addition to detailed descriptions of all equipment manufactured by the company, the book contains a great deal of specialized engineering information that will be of interest to executives and engineer operating officials, including discussions of chain drives, the selection, application, operation and care of chain.

Special sections of the catalog are devoted to detailed discussions of conveying systems as applied to the automobile industry, automobile laundries, power plants, foundries, cement mills, glass plants, pulp mills, sewage disposal plants, tire and rubber plants and canning plants. Specific installations are shown, with carefully prepared line drawings of entire plants and conveyor installations. In many cases definite figures are given showing the savings that have been attained, or the increase in production that has been achieved by the installation of conveying systems.

The book is profusely illustrated with several hundred photographs of specific installations, in addition to the large number of line drawings. The last 30 pages of the catalog are given over to general engineering data of a nature that will assist the executive or engineer operating official in the selection, construction, operation and maintenance of systems for the mechanical handling of material.

Rates for display advertisements in the Broadcast Section are given below. If you want to buy or sell used equipment, if you want a job or need a man, advertise your wants in Pit and Quarry. Advertisement copy for publication in the next issue should reach our office within one week after the date of this issue.

RATES PER INSERTION	1 Inch	2 Inches	3 Inches	4 Inches	5 Inches	6 Inches	8 Inches	9 Inches	10 Inches	12 Inches	15 Inches	20 Inches	30 Inches
1 Insertion	$ 3.75	$ 7.25	$10.75	$14.25	$17.75	$ 21.25	$28.25	$31.75	$35.25	$42 25	$56.25	$70 25	$105.00
2 Insertions	3.75	7.25	10.70	14.20	17.65	21.15	28.15	31.65	35.15	42.15	56 15	70.00	104.00
3 Insertions	3.75	7.20	10.65	14.15	17.55	21.05	28.05	31.55	35.10	42.05	56.05	69.75	103.00
4 Insertions	3.70	7.15	10.60	14.10	17.45	20.95	27.95	31.45	35.00	41.95	55.90	68.75	101.00
8 Insertions	3.65	7.05	10.50	14.00	17.25	20.75	27.75	31.25	34.80	41.75	55.70	67.50	98.00
13 Insertions	3.60	6.95	10.40	13.90	17.05	20.55	27.55	31.05	34.60	41.55	55.55	66.25	94.00
26 Insertions	3.50	6.75	10.20	13.70	13.65	20.05	27.05	30.65	34.20	41.05	55.05	64.00	88.00

INFORMATION—"Broadcast" space is sold by the advertising "inch." Each page contains 30 inches. The width of the page is divided into 3 columns, each 2¼ inches wide. Each column contains 10 inches measured the length of the column. Any space may be used measured by the *even* inch in height (not fractions), by 1, 2 or 3 columns in width The size of a space is its height in inches multiplied by the number of columns in width. Example: a space 3 inches high by 2 columns wide is 6 inches. Copy changes made without additional charge.

It Pays to Advertise in PIT AND QUARRY

"Results Satisfactory"

—Coplay Cement Mfg. Co.

Complete Service Publishing Company

538 South Clark Street CHICAGO

Machinery for Sale

SPECIALS
1—3-Roll Bradley Mill.
1—No. 6 Williams Universal Hammer Mill

CRUSHERS

Crushing Rolls

2—8"x5", 2—24"x12", 1—24"x14", 1—30"x12", 1—30"x16", 2—36"x16", 2—42"x16", 1—54"x24".

Gyratory

All sizes from No. 2 Reduction to No. 12K.

Jaw

1—2"x6", 1—6"x3", 2—8"x10", 1—6"x15", 2—9"x15", 1—11"x22", 2—12"x24", 1—18"x36", 1—24"x36", 1—60"x84".

Rotary

Two No. 0, two No. 1, one No. 1½, and one No. 2 Sturtevant Rotary Fine Crushers.

Ring Roll

One No. 1 and one No. 2 Duplex Sturtevant ring roll mills.

Ball and Tube Mills

3', 4', 4½', 5', 5½', 6', 8' Hardinge Mills and Tube Mills.

DRYERS

One 3'x30', Three 4'x30', One 4½'x30', One 5'x40', One 5½'x40', One 6'x60', One 7'x60' and One 8'x80' Direct Heat Rotary Dryers, One 5'x25', One 6'x30', Two 8'x80' Ruggles Coles type "A" and One 5'x30' indirect heat rotary dryer.

KILNS

3'x15', 4½'x36', 6'x60', 6'x70', 6'x100'. 6'x120'; 1—4½' Bruckner Roasting Furnace.

MILLS

Two 33" and two 42" Fuller Lehigh Mills.
1 No. 0000, 1 No. 00, 2 No. 1, 2—4 Roll, and 1—5 Roll Raymond.
Swing Hammer Mills, Griffin Mills, Attrition and Cage Mills.
Air separators, Screens, Elevators and Conveyors, Sand Washers and Classifiers.

The Heineken Engineering Corp.
Industrial Engineers
117 Liberty St., New York City
Courtlandt 5130

FOR SALE

SPECIALS

3—7'x100' Bonnot Rotary Kilns
2—8'x60' Ruggles-Coles D.H. Dryers
2—7'6"x60' Bonnot ½" D.H. Dryers
2—6'x100' Bonnot 9/16" D.H. Dryers
1—8'x85' R-C double shell D. H. Dryer
1—5'x30' R-C double shell D. H. Dryer
6—5'x22' Gates iron lined Tube Mills
1—Champion 22"x50" Jaw Crusher, Overhauled
1—6" McCully Fine Reduction Gyratory Crusher
1—7'x48" Hardinge Ball Mill, complete, pulverized 200 tons only.
1—No. 43 Marcy Ball Mill, complete
1—No. 515 Allis-Chalmers Ball Mill
2—8'x8' Allis-Chalmers Ball Mills
6—Tube Mills, silex lined, 5'6"x20', 5x22, 6x18, 5x12, iron lined 3'x12' and other sizes.
20—Pebble Mills, 7x10, 7x7, 6x5, 5x4, 4'6x6, 4x5, 3x3'6.
2—5 roll Raymond Mills, High and Low Side
2—8' dia. Raymond Separators, complete
3—Gayco Separators, 30", 10', 14'

Jaw, Gyratory, Roll Crushers, all sizes, types.
Rotary, Kilns, Dryers, all sizes, types, not listed above.
Swing Hammer Mills, all sizes, types.
PULVERIZERS—Raymond, Hardinge, Sturtevant, Kent, Griffin, all sizes and types—Ball, Tube and Pebble Mills,—Air Separators.

Request your copy of latest list No. 8

Consolidated Products Co. Inc.,
17-19 Park Row **New York City**
Barclay 0600

Shops and Yards at Newark, N. J. cover six acres.

WE WILL BUY YOUR SURPLUS MACHINERY.

LOCOMOTIVE CRANES

FOR SALE OR RENT

1—Type D ORTON & STEINBRENNER, 22 tons cap., 8 wheel MCB, double drums, 55 ft. boom. Fine condition.
1—No. 4 BROWNHOIST, 15-20 ton cap., 8 wheel MCB, double drums, 48'3½" boom, ASME boiler. Thoroughly overhauled.
1—No. 8 BROWNING, heavy 20 ton cap., 8 wheel MCB, double drums, 50' boom, ASME boiler, separate swinger. Just overhauled.

PHILIP T.
KING
"The Crane Man"
50 Church St. **New York**

MOTOR

1—Westinghouse 40 hp., 3 phase, 60 cycle, slip ring 870 R. P. M., complete with 10 in. dia. 12 in. face pulley and resistance. Guaranteed the same as a new motor.

HOISTS

1—Thomas two-drum with attached swinger, 52-H. P. A. C. motor, 90% new.
1—National three-drum and swinger, 75 H. P. A. C. motor.

TRUCK CRANES

1—P. & H. and 1— Universal Truck Cranes on White and Mack Trucks.

GAS. LOCOMOTIVES

16—Capacity 4 tons to 20 tons, 24-in.—36 in. and standard gauge.

STEAM LOCOMOTIVES

6—Capacity 20 tons to 50 tons.

CLAM SHELL BUCKETS

16—Capacity ¼ yd. to 2 yd., single and double line, all makes.

LIME PULVERIZER

1—Jeffrey Lime Pulverizer, complete with elevator, vibrator screen, etc.

RING ROLL MILL

Sturtevant No. 2 Duplex, used two weeks.

TUBE MILLS

2—Schmidt 5½ ft. 22 ft. silex lined, perfect condition.

CRUSHERS

1—Telsmith 10-A, all steel Gyratory, practically new condition.
JAW CRUSHERS: 4 x 5 to 40 x 48.
GYRATORY CRUSHERS: All sizes and makes, both primary and reduction.

A. J. O'NEILL CO.
1524 Chestnut St., Philadelphia, Pa.

Slip Ring Motors for Quarry Service

1—200 H. P. 3 ph. 60 cy. 440 V. G.E. type I.M. 450 RPM, 3 bearing belt drive, enclosed slip rings.
1—150 H.P. 3 ph. 60 cy. 440 V. G.E. type I.M. 450 RPM, 2 bearing with enclosed slip rings.
1—150 H.P. 3 ph. 60 cy. 440 V. Crocker-Wheeler type 127-AQ, 440 RPM 2 bearing variable speed control.

MUST BE SOLD AT ONCE

John D. Crawbuck Company
Empire Bldg. :: Pittsburgh, Pa.